5. OCCUPATIONAL MEDICAL SURVEILLANCE PROGRAM

The INEEL task-site personnel shall participate in the INEEL OMP, as required by DOE Order 5480.8a, "Contractor Occupational Medical Program," and OSHA 29 CFR 1910.120/1926.65. Medical surveillance examinations will be provided before assignment, annually, and after termination of hazardous waste site duties or employment. This includes personnel who are or may be exposed to hazardous substances at or above the OSHA-permissible exposure limit (PEL) or published exposure limits, without regard to respirator use, for 30 or more days per year. Personnel who wear a respirator in performance of their job, or who are required to take respirator training to perform their duties under this plan, must participate in the medical evaluation program for respirator use at least annually as required by 29 CFR 1910.134.

A single copy of the project HASP, job hazard analysis, required PPE, confined space entry (as applicable), and other exposure-related information shall be made available upon request by the PM to an OMP physician (and subcontractor physicians) conducting medical surveillance for employees participating in this project. Exposure monitoring results and hazard information furnished to the OMP physician must be supplemented or updated annually as long as the employee is required to maintain a hazardous waste/ material employee medical clearance.

The OMP physician shall evaluate the physical ability of an employee to perform the work assigned, as identified in the OU 7-13/14 integrated probing project HASP, or other job-related documentation. A documented medical clearance (physician's written opinion) will be provided to the employee and line management stating whether the employee has any detected medical condition that would place him/her at increased risk of material impairment of health from work in hazardous waste operations, emergency response, respirator use, and confined space entry (as applicable). The physician may impose restrictions on the employee by limiting the amount or type of work performed. Occupational Medical Program responsibilities for personnel assigned to hazardous waste site activities, include, but are not limited to the following:

- Provide current comprehensive medical examinations (as determined by the examining physician) at an INEEL medical facility for full-time personnel
- Obtain records/reports from employee's private physicians, as required by the OMP director
- Perform a medical evaluation on return-to-work cases following an absence in excess of one work week (40 consecutive work hours) resulting from illness or injury
- Conduct a medical evaluation in the event that management questions the ability of an employee to work or if an employee questions his/her own ability to work.

Note 1: Project management shall ensure that a Form 3402.02, "Employee Job Function Evaluation," is validated by the project IH and then submitted to the OMP for review before any employee can begin work on the project.

Note 2: Employees shall not be permitted to work on the project until the OMP has sent a medical clearance to management or the IH has validated that no potential exists for exposure above the established action levels (AL) and that no additional substance-specific medical evaluations are required.

The attending physician will evaluate all information provided, including medical questionnaires; physical examination findings; blood chemistry and urinalysis results; preexisting medical conditions; nature of work to be performed; actual and potential hazards and exposures; and other factors deemed appropriate by the physician to determine the following for each employee:

- Ability to perform relevant occupational tasks
- Ability to use respiratory protection
- Ability to work in other PPE and heat or cold-stress environments
- Requirement for entry into substance-specific medical surveillance programs.

If the OMP does not have sufficient information to complete a medical evaluation before respirator training, the employee's supervisor will be notified. The employee will not be permitted to fit test until the needed information is provided and any additional examination or testing is completed.

5.1 Subcontractor Workers

Subcontractor task-site personnel shall participate in a subcontractor medical surveillance program that satisfies the requirements of OSHA 29 CFR 1910.120/1926.65. This program must make medical examinations available before assignment, annually, and after termination of hazardous waste duties. The physician's written opinion will serve as documentation that subcontractor personnel are fit for duty.

Medical data from the subcontractor employee's private physician, collected pursuant to hazardous material worker qualification, shall be made available to the INEEL OMP physicians upon request. Also, subcontractor employee past radiation exposure histories must be submitted to the INEEL radiation dosimetry and records section, in accordance with MCP-188, "Issuing TLDs and Obtaining Personnel Dose History" (INEEL 2002) and MCP-2381, "Personnel Exposure Questionnaire" (INEEL 2001).

5.2 Injuries on the Task Site

It is INEEL policy that an INEEL OMP physician examines all injured personnel. Injured personnel include employees injured on the job, employees experiencing signs and symptoms consistent with exposure to a hazardous material, or those that have been exposed to toxic substances or physical or radiological agents in excess of allowable limits.

Note: Subcontractor employees will be taken to the closest INEEL medical facility to have an injury stabilized or occupational exposure evaluated before transport to the subcontractor's treating physician or medical facility.

If a known or suspected injury or illness results from exposure to a hazardous substance or physical or radiological agent, the employee shall be transported to the nearest INEEL medical facility for evaluation and treatment, as necessary. The FTL or HSO is responsible for obtaining as much of the following information as is available to accompany the individual to the medical facility:

- Name, job title, work (site) location, and supervisor's name and phone number
- Substance(s), physical or radiological agent(s) exposed to (known or suspected); material safety data sheet (MSDS), if available

- Nature of the incident, injury, or exposure, and related signs or symptoms of exposure
- First-aid or other measures taken
- Locations, dates, and results of any airborne exposure monitoring or sampling
- Personal protective equipment in use during this work (i.e., type of respirator and cartridge used)

Further medical evaluation will be determined by the examining and treating physician according to the signs and symptoms observed, hazard involved, exposure level, and specific medical surveillance requirements established by the OMP director in compliance with 29 CFR 1910.120/1926.65.

The RWMC shift supervisor will be contacted if any injury or illness occurs at any OU 7-13/14 project site. As soon as possible after an injured employee has been transported to the INEEL medical facility, the FTL or designee will make notifications as indicated in Section 11.4.5.

RadCon personnel will evaluate all actual and/or suspected abnormal radiological exposures in excess of allowable limits and will establish the follow-up actions. For internal uptakes (as calculated committed effective dose equivalent values), EDF-INEL003, "Established Levels of Radio nuclide Intake for Consideration of Medical Intervention" will be used as the basis for this evaluation and follow-up actions. An OMP physician will examine all wounds to determine nature and extent of the injury. The RadCon supervisor will determine if the wound can be bandaged adequately for entry into a radiological contamination area, in accordance with Article 542 of the Manual 15A (INEEL 2000).

Selected project personnel will submit baseline and project termination bioassay samples (as determined by RadCon) because of plutonium isotopes present in SDA pits. If any uptake event is suspected, an additional sample will be submitted for analysis in accordance with MCP-191, "Radiological Internal Dosimetry" (INEEL 2001).

5.3 Substance-Specific Medical Surveillance

The only contaminants of concern at OU 7-13/14 integrated probing project pits in the SDA that potentially would require additional substance-specific regulatory medical surveillance are asbestos, cadmium, lead, and beryllium. The release potential from these contaminants is considered very low, based on (1) the nature of the probe installation (sonic, with no return material back to the surface), (2) dust-control airhood used during installation, and pore size of the stainless steel porous portion of select Type-B probes. No occupational exposures approaching the regulatory substance-specific action limits are anticipated. This is based on (1) factors listed above, (2) the quantity of material present (see Table 8-3), (3) distribution and mixing of these contaminants from flooding and subsidence events, (4) waste seam location under a clean overburden layer, (5) sampling confinement and barriers, (6) administrative controls, and (7) worker training. Section 8 details specific contaminants, and Table 8-4 evaluates potential exposure for each.

6. ACCIDENT PREVENTION PROGRAM

The OU 7-13/14 integrated probing project activities present numerous potential chemical, radiological, and physical hazards to personnel conducting the required tasks. It is critical that all personnel understand and follow the task-specific requirements of this HASP. Engineering controls, hazard isolation, specialized work practices, and the use of PPE will be implemented to eliminate or mitigate all potential hazards and exposures. However, every person on the project site must play a role in identifying and controlling hazards.

6.1 Voluntary Protection Program and Integrated Safety Management

The INEEL safety processes embrace the Voluntary Protection Program (VPP) and Integrated Safety Management System (ISMS) criteria, principles, and concepts as part of operational excellence. All levels of management are responsible for implementing safety policies and programs and maintaining a safe and healthy work environment. Project personnel are expected to take a proactive role to prevent accidents, ensure safe working conditions for themselves and fellow personnel, and comply with all work control documents and procedures.

The **ISMS** is focused on the **system** side of conducting operations and **VPP** concentrates on the **people** side of conducting work, but both define work scope, identify and analyze hazards, and mitigate the hazards. The VPP is a process that promotes and encourages continuous safety improvement but is not a requirement of any regulatory agency. The INEEL and affected subcontractors participate in VPP and ISMS for the safety of employees. Additional information regarding INEEL VPP and ISMS programs can be found in PDD-1005, Site Operations. The five key elements of VPP and ISMS are listed below.

Voluntary Protection Program	**Integrated Safety Management System**
Management leadership	Define work scope
Employee involvement	Analyze hazards
Work site analysis	Develop/implement controls
Hazard prevention and control	Perform work within controls
Safety and health training	Provide feedback and improvement

6.2 General Safe-Work Practices

The following procedures are mandatory for all INEEL and subcontractor personnel working on the OU 7-13/14 project site. All site visitors entering the task site area **(SZ** and beyond) must follow these procedures. **Failure to follow these practices may result in permanent removal from the OU 7-13/14 project site and other disciplinary actions.** The FTL and HSO are responsible for ensuring these hazard control practices are followed at the OU 7-13/14 project site:

- Access is limited to authorized INEEL, subcontractor, and visitor personnel only
- All personnel have the authority to initiate **STOP WORK** actions, using MCP-553, "Stop Work Authority" (INEEL 200 1).

- Absolutely no eating, drinking, chewing gum or tobacco, smoking, applying cosmetics, or any other practice that increases the probability of hand-to-mouth transfer and ingestion of materials shall be allowed, except in designated areas.

- Be aware of and comply with all safety signs, color codes, and barriers. Adhere to PRD-5117, "Accident Prevention Signs, Tags, Barriers and Color Codes" (INEEL 2001).

- Be alert for dangerous situations, strong or irritating odors, airborne dusts or vapors, and broken containers. Report all potentially dangerous situations to the FTL or HSO.

- Avoid direct contact with potentially contaminated substances. Do not walk through spills or other areas of contamination. Avoid kneeling, leaning, or sitting on equipment or ground that may be contaminated.

- Be familiar with the physical characteristics of the task site, including, but not limited to:

  - Wind direction
  - Accessibility of fellow personnel, equipment, and vehicles
  - Communications at the task site and with RWMC **SS**
  - Areas of known or suspected contamination at the SDA
  - Major roads and means of access to and from the SDA
  - Nearest water sources and fire-fighting equipment
  - RWMC project warning devices and alarms
  - Capabilities and location of RWMC incident response team and INEEL fire department.

- Report all broken skin or open wounds to the HSO or FTL. The OMP physician will consider how the wound can be bandaged and will recommend PPE to be worn by the injured employee. The RWMC RadCon supervisor or designee will determine if the wound presents a significant risk of internal radiological exposure. Personnel with unprotected wounds shall not be permitted to enter the EZ.

- Prevent releases of hazardous materials, including those used at the task site. If a spill occurs, try to isolate the source (if possible, and if this does not create a greater exposure potential); then report it to the FTL or HSO. The RWMC shift supervisor will be notified and additional actions taken as described in Subsection 11.1.4. Appropriate spill response kits, or other confinement and absorbent materials, will be maintained at the task site.

- Avoid unnecessary and excessive movement during decontamination (if required).

- Project personnel will ensure that electrical equipment, wiring, cables, switches, and current overload protection meet applicable regulations and are maintained in a manner that provides protection for project personnel from shock hazards, injury, and prevents property damage, in accordance with MCP-3650, "Chapter IX Level I Lockouts and Tagouts" (INEEL 2001),

MCP-3651, "Chapter IX Level II Lockout and Tagouts" (INEEL 2001), and RWMC supplements. Ground-fault protection will be provided whenever electrical equipment is used outdoors.

- Keep all ignition sources at least 15 m (50 ft) from explosive or flammable environments and use nonsparking, explosion-proof equipment (if advised to do so by a safety professional).

- Personnel working in the exclusion or controlled access zone shall implement the "buddy system" (see Subsection 6.5).

- Personnel who wear contact lenses shall comply with PRD-5121, "Personal Protective Equipment" (INEEL 2002).

6.3 As Low as Reasonably Achievable Principles

Radiation exposure of OU 7-13/14 integrated probing project personnel shall be controlled so that radiation exposures are well below regulatory limits, and so there is no radiation exposure without commensurate benefit. Unplanned and preventable exposures are considered unacceptable. All project tasks will be evaluated with the goal to eliminate or minimize exposures. Following ALARA principles and practices is the responsibility of all project personnel. All personnel working at OU 7-13/14 project sites must strive to keep both external and internal radiation doses ALARA by adopting the following practices. The Type-B probe installation, sampling, and logging tasks will be the primary focus for contamination control and for applying engineering controls to reduce radiation exposure.

6.3.1 External Radiation Dose Reduction

Sources for external radiation exposure at the OU 7-13/14 project site include waste in Pits 4, 9, and 10, logging tool sources (isotopic and neutron generators), potential "shine" from open probes, adjacent pits or trenches, and samples brought to the surface. Basic protective measures used to reduce external doses include minimizing time in radiation areas, maximizing distance from the source of radiation, and using shielding whenever possible. The following are methods to minimize external doses:

Methods to Minimize Time

- Use mockups and practice runs that will duplicate OU 7-13/14 integrated probing, logging, and sampling activities

- Plan and discuss tasks before entering designated radiation areas (including having all equipment and tools prepared)

- Perform as much work as possible outside radiation areas and take advantage of lower dose rate areas (as shown on the radiological survey maps) or away from logging tool

- Take the most direct route to the task site and work efficiently

- If problems occur in the radiation areas, hold technical discussions outside radiation area, then return to the work area to complete the task

- If stay times are required, know your stay time and use appropriate signal and communication method to let others in the area know when the stay time is up

- Respond to all alarming electronic dosimetry or instrumentation

- Know your current dose and your dose limit. DO NOT EXCEED YOUR DOSE LIMIT.

Methods to Maximize Distance from Sources of Radiation

- Wear alarming electronic dosimetry as stated on the RWP
- Comply with RCT survey hold points identified in OU 7-13/14 procedures and RWP before entering areas where potential sources of contamination may exist
- Observe minimum distance requirements established in procedures for operational drill rig from control trailer and unsheltered field crew
- Follow administrative procedural controls for drilling and sampling operations and downhole logging, and use the provided extension tool for placing the sealed source in the activated logging tool
- Stay as far away from the source of radiation as possible (extremely important for point sources where, in general, if the distance between the source is doubled, the dose rate falls to one-fourth the original dose rate)
- Be familiar with the RWP expected dose rates in OU 7-13/14 project areas and limiting conditions with respect to dose limits.

Proper Use of Shielding

- Take advantage of the site equipment and enclosures to shield yourself from radiation sources
- Keep the logging sealed source in a secure, shielded configuration (storage cask or logging tool) when not in use
- Ensure interlocks are operational on neutron generating device and tool is only activated when lowered below ground surface
- Wear safety glasses to protect eyes from beta radiation
- Conduct Type B sampling tasks inside designated glove-bag confinement
- Verify integrity of all confinements before initiating potential radioactive sample material-handling operations.

6.3.2 Internal Radiation Dose Reduction

An internal radiation dose potential exists at the OU 7-13/14 integrated probing project site from radiological contamination present in the pits. Sources include pit waste content (e.g., sludge and debris, waste containers) and contaminated soils surrounding breached containers. The clean overburden layer over the waste seam provides a protective layer and all Type B probes are designed with sealing surfaces to prevent contaminant migration to the surface (other than in designated sampling ports).

Therefore, potential migration is not anticipated. Installing and sampling Type B probes presents the greatest potential for encountering radiological contamination.

An internal dose is a result of radioactive material being taken into the body. Radioactive material can enter the body through inhalation, ingestion, absorption through wounds, or injection from a puncture wound. Reducing the potential for radioactive material to enter the body is critical to avoid internal dose. The following are methods to minimize internal radiation dose:

- Know the OU 7-13/14 integrated probing project potential sources for encountering contamination and use all engineering controls
- Inspect glove-bag enclosure before use in accordance with MCP-199, "Total Containment Glove Bags and Glove Boxes" (INEEL 2001)
- Use high-efficiency particulate air (HEPA)-filtered glove bag for all vapor and water sampling tasks
- Conduct a whole body personal survey as required by RWP, then proceed directly to the personal contamination monitor (PCM)
- Report all wounds or cuts (including scratches and scrapes) before entering radiological controlled areas
- Wash hands, arms, face, and any other exposed skin before eating, drinking, smoking, or participating in other activities that may provide a pathway for contaminants.

6.4 Nonradiological Contaminant Exposure Avoidance

The waste in Pits 4, 9, and 10 are mixed waste containing both radiological and nonradiological (organic and inorganic chemicals and hazardous materials) constituents. Table 8-3 in Section 8 lists the dominant nonradiological contaminants to be encountered by the integrated probing of Pits 4, 9, 10 (and 6, if investigated). The same potential exposure pathways that exist for radiological contamination apply equally to these nonradiological contaminants. Each contaminant has distinct physical, chemical, and mechanical properties that determine its toxicity.

Threshold limit values (TLVs) have been established to provide guidelines to evaluate airborne and skin exposure to these chemicals and materials (American Conference of Governmental Industrial Hygienist 7th Edition). They represent levels and conditions under which it is believed that nearly all workers may be exposed, day after day, without adverse health effects. Based on these TLVs, specific action limits have been established (see Table 8-7) to hrther limit the potential for approaching these contaminant TLVs.

The same engineering controls employed to eliminate or mitigate airborne radioactivity (HEPA-filtered glove bags for sampling) will serve to control nonradiological airborne contaminants. Every effort will be made to isolate the source of these hazards through engineering controls and confinement, where feasible. Some of these contaminants pose other exposure hazards from contact and skin absorption, and implementing barriers will serve to minimize the potential for exposures. Methods of exposure avoidance at OU 7-13/14 integrated probing project sites include the following:

- Collect Type B samples directly in HEPA-filtered containers to isolate the source of contamination
- Wear all required PPE, inspect all pieces before donning, tape all seams
- Ensure all water sample containers are securely closed before transport

- Perform required radiological surveys as directed by the task RWP (detectable radiological contamination may be indication of the presence of nonradiological contaminants)

- Wash hands, arms, face, and any other exposed skin before eating, drinking, smoking, or participating in other activities that may provide a pathway for contaminants.

6.5 The Buddy System

The "buddy system" will be used at OU 7-13/14 integrated probing project sites when personnel are in the EZ while actively operating (e.g., installing probes, logging, sampling). The buddy system requires workers to assess and monitor their buddy's mental and physical well being during the course of the workday. Buddies must be able to perform the following:

- Provide assistance

- Verify the integrity of PPE

- Observe their partner for signs and symptoms of heat stress, cold stress, or contaminant exposure

- Notify other personnel in the EZ if emergency assistance is needed.

Workers need to be able to see or hear and effectively communicate with their buddy at all times. Task-site personnel will continually check their buddy while work is being performed.

7. SITE CONTROL AND SECURITY

Based on the potential to encounter radiological and chemical contamination when conducting OU 7-13/14 integrated probing project tasks, formal work zones and radiological areas will be established for all tasks within the SDA sites. Project tasks conducted at the Cold Test Pit South (CTP-S) will be conducted in designated work areas, construction area, or may use training-use-only radiological areas or HAZWOPER zones for readiness assessments.

Entry and exit from task-site work zones will be controlled through the appropriate use of barriers, signs, and other measures described in this section, and PRD-5117 (INEEL 2001) defines the general requirements. Personnel not directly involved with OU 7-13/14 integrated probing activities shall be excluded from entering designated work zones. Nonfield team members, such as inspectors, may be admitted to OU 7-13/14 task sites, provided they are on official business, authorized by the HSO, and have met all the training requirements for the area they wish to access, in accordance with Section 4.

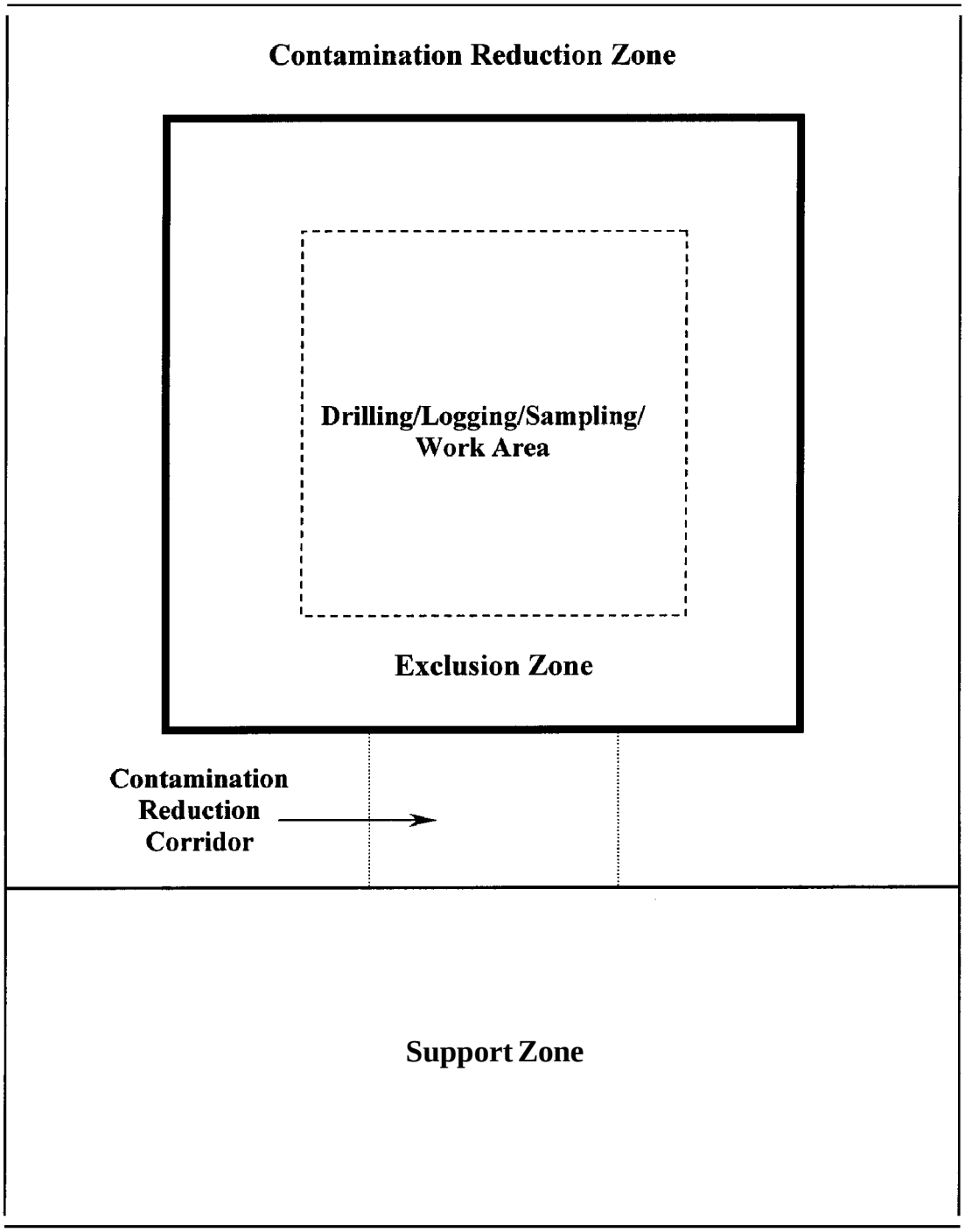
Note: Visitors may not be allowed beyond the SZ during certain OU 7-13/14 project tasks (e.g., probehole installation, drill rig movement, sampling, and others as determined by the HSO) to minimize safety or health hazards or as an ALARA consideration. The determination of a visitor's need for access beyond the SZ at the OU 7-13/14 project site will be made by the HSO in consultation with RWMC RadCon personnel.

Both radiological and nonradiological hazards (including industrial safety hazards) will be evaluated when establishing the initial work zone size and location. Common barriers may be used to delineate both radiological and nonradiological work-zone postings, depending on the nature and extent of contamination. If common barriers are used, they will be delineated and posted according to both sets of requirements (29 CFR 1910.120 and 10 CFR 835), using appropriate colored rope and postings.

Work zones may include the following:

- Exclusion zone
- Contamination reduction zone (CRZ), including a contamination reduction corridor (CRC) (the CRC may not be posted, but is the primary pathway from the CRZ to the EZ)
- Support zone.

Figure 7-1 illustrates an example work zone that will be established for each OU 7-13/14 task site (i.e., Pits 4, 9, and 10). Figure 7-2 illustrates a generalized configuration for CTP-designated work areas. These figures represent the general configuration of an OU 7-13/14 work zones and is not meant to provide an exact layout or configuration of all equipment or zone sizes. Several factors may result in changing cause-zone configuration, size, and location. These include (1) pit being investigated, (2) project tasks being conducted, site monitoring data, and changing wind direction. Additionally, entrances and egress points may change, based on these same factors. Changes in zone configuration and size will be decided by the HSO in conjunction with the IH, RE, RCT, and FTL (as appropriate).



Not to scale

General work zones for the Operable Unit 7-13/14 integrated probing project site in Subsurface Disposal Area.

Figure 7-1. General work zones

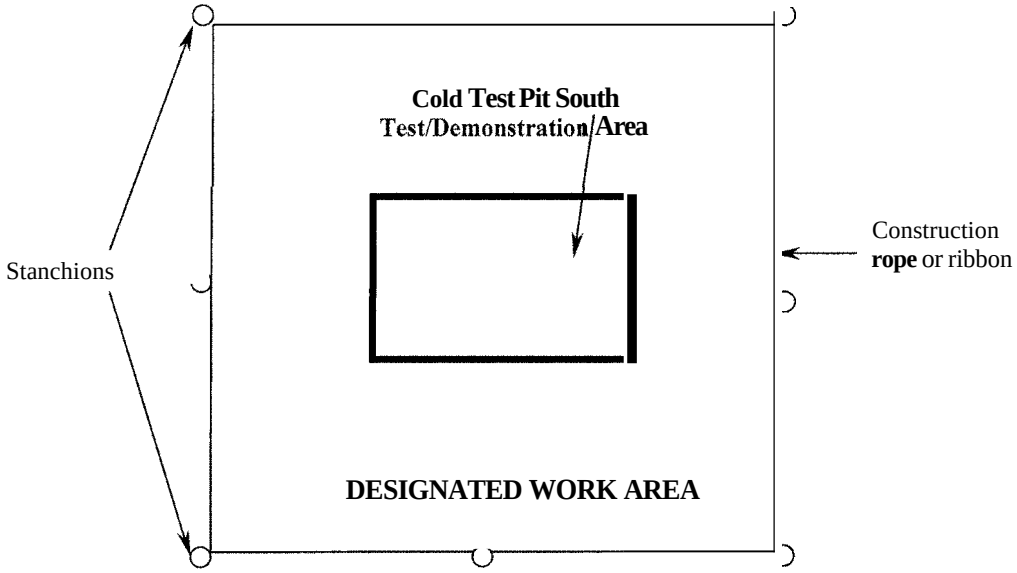


Figure 7-2. General work zones for the OU 7-13/14 integrated probing project site at Cold Test Pit-South.

The MCP-187, "Posting Radiological Control Areas" (INEEL 2002), shall be used to post and control access to radiologically controlled areas at the OU 7-13/14 integrated probing project site. Radiation control personnel at OU 7-13/14 integrated probing project sites will establish radiologically controlled areas as required. These may include the following:

- Radiological buffer area (RBA) (which is the entire SDA)
- Radiation area (if required area around logging source or neutron generator)
- High radiation area (if required, resulting from dose rate from logging source)
- Radioactive material area
- Underground radioactive material area (pit areas)
- Radiological control trailer (CRC/SZ line) with a PCM.

7.1 Exclusion Zone

The EZ will be large enough to encompass the primary task area (e.g., drilling, logging, sampling) and allow equipment and personnel to move about freely and conduct necessary material handling tasks. The minimum number of personnel required to safely perform the OU 7-13/14 integrated probing project tasks will be allowed into the EZ. Because the drill rig and sampling glove bag will be moving between probehole locations, the EZ will be moved or reconfigured to encompass an area large enough to prevent nonfield team personnel in the SZ from being exposed to potential safety and health hazards. The EZ shape and size will be based on the specific area being worked in.

The EZ is a controlled access zone at all times. An entry and exit point will be established at the periphery of the EZ/CRC to regulate the flow of personnel and equipment. The EZ boundary will be

delineated with rope or printed hazard ribbon and posted with signs. Factors that will be considered when establishing the EZ boundary include (1) tasks being conducted, (2) air monitoring data, (3) radiological (4) contamination data, (5) radiation fields, (6) equipment in use, (7) the physical area necessary to conduct site operations, and **(8)** the potential for contaminants to be blown from the area. The boundary may be expanded or contracted as this information becomes available. All personnel who enter the EZ will wear the appropriate level of PPE for the degree and type of hazards present, as listed in Section 9.

Type B sampling tasks (water and vapor) will be conducted inside a glove bag equipped with a HEPA filter. The glove bag will be constructed, tested, and operated in accordance with MCP-199 (INEEL 2001). Samples and other materials inside the glove bag will not be released until required radiological surveys have been completed (e.g., hand-held instruments and swipes) in accordance with MCP-139, "Radiological Surveys," (INEEL 2001), MCP-425, "Radiological Release Surveys and the Control and Movement of Contaminated Materials "(2003) and as directed by the RWP.

7.2 Contamination Reduction Zone and Corridor

The CRZ and CRC for the OU 7-13/14 integrated probing project are transition areas surrounding the EZ, and are located between the EZ and SZ (see Figure 7-1). The CRZ will not be formally delineated, but will be designated by the travel path from the established CRZ-controlled entry and exit point and the EZ entry and exit point. The CRZ and CRC will serve to buffer and hrther reduce the probability of the SZ becoming contaminated. The CRC will encompass an area large enough to allow for equipment and personnel to travel through. All project personnel and equipment (except for the drill rig) entering and exiting the EZ will transition through the CRC. Restricting traffic to these controlled areas will minimize physical transfer of contaminating substances on personnel, equipment, or in the air. The CRZ and CRC may serve as staging areas for equipment and temporary rest areas for personnel. Because of the potential for contamination (migration from airborne contamination in the EZ), PPE and sample packaging and preparation equipment will be stored in the SZ.

If radiological or mixed contamination (nonradiological or radiological) is found, work will stop until a new RWP is written; then radiological decontamination techniques will be used (as described in Section 10.2.2. One of the radiological decontamination goals is to not generate any free liquid. Shielding problems (alpha contamination shielded by water) will be minimized by use of dry-decontamination techniques (e.g., HEPA vacuum and adhesive tape) and avoiding wet methods. If necessary, wet methods will be used. All containerized decontamination waste will be staged in the CRZ.

A nonradiological decontamination pad may be established if it is believed that residual nonradiological contamination is present on equipment following radiological free release. The OU 7-13/14 integrated probing project IH will be responsible for nonradiological contamination issues and determining the most appropriate decontamination methods, as described in Section 10.2.2. A designated portion of the CRC, or other area, will be established for the nonradiological decontamination of equipment (if required). All decontamination supplies (e.g., nonradiological decontamination solution and wipes), used nonradiological PPE, and debris waste containers may be located in the CRC.

7.3 Support Zone

The SZ will be considered a radiological and nonradiological "clean" area. The location of the SZ will be in a prevailing upwind direction to the EZ (where possible) and readily accessible to the nearest road. The SZ is an area outside the CRZ. This area will not be delineated since the SDA is a controlled area requiring specific RWMC training for entry. Support trailers (control trailer and RadCon trailers), vehicle parking, additional emergency equipment, extra PPE, and stored monitoring and sampling

equipment may be located in the **SZ.** Visitors who do not have appropriate training to enter other project areas will be restricted to this zone.

OU 7-13/14 integrated probing project site work zones and radiologically controlled areas will be maintained during off-hours and weekends by personnel ensuring they are in good condition before exiting the project site for the day. These zones and areas will remain intact until all site tasks have been completed and equipment and supplies have been decontaminated and removed from the project site. The HSO and RCT will ensure that site zones are posted and intact when leaving the site, and will be responsible to break down the zones when site activities have been completed.

Note: Only RadCon personnel can post and remove radiological postings and raise and lower radiological barriers. This will be accomplished in accordance with the Manual 15A, *Radiation Protection INEEL Radiological Control Manual* (INEEL 2000), and MCP-187, "Posting Radiological Control Areas" (INEEL 2002).

7.4 Designated Work Areas

OU 7-13/14 integrated probing project activities at the Cold Test Pit (CTP) will require designated work areas to be established to prevent non-field-team-member personnel from being exposed to safety and equipment hazards. The designated work area will be delineated with rope or other barriers and posted to alert non-field-team members of the area. A designated work area or construction area will be delineated for all drilling, logging or sampling operations at the CTP established for test or training purposes. "Training use only" radiological areas or HAZWOPER zones may be established in conjunction with the designated work area for mock-ups or readiness assessments. Only trained field team members will be allowed in the designated work area.

7.5 Designated Eating and Smoking Area

Ingestion of hazardous substances is likely when workers do not practice good personal hygiene habits. It is important to wash hands, face, and other exposed skin thoroughly after completion of work and before smoking, eating, drinking, and chewing gum or tobacco. **No smoking, chewing, eating, drinking, applying lip balm, or similar activity is allowed within the OU 7-13/14 site work zones.** When required by the RWP, all personnel will complete the required radiological survey with hand-held instruments. Additionally, personnel will complete an automated, whole-body survey at the PCM station, or equivalent survey method (as determined by RadCon), as stated in the RWP. As a minimum, all personnel should wash their hands before using designated eating or smoking areas.

The designated eating areas for the OU 7-13/14 task-site personnel will be the RWMC WMF-657, the RWMC cafeteria, CTP trailer, other RWMC designated eating areas outside the SDA or outside the RWMC (e.g., Central Facilities Area [CFA] cafeteria).

Personnel will not be permitted to smoke in the RWMC SDA. Project personnel will use only approved RWMC facility or CTP smoking areas or smoking areas located outside the RWMC.

All personnel will comply with INEEL smoking polices, including disposing of smoking materials in the proper receptacle.

8. HAZARD ASSESSMENT AND MITIGATION

The overall objectives of this hazard assessment and mitigation section are to provide guidance on the following activities:

- Evaluate existing OU 7-13/14 (i.e., Pits 4, 9, 10, and 6) buried waste contents where intrusive activities will occur to determine the radiological, chemical, biological exposure potential to OU 7-13/14 personnel by all routes of entry

- Evaluate all OU 7-13/14 integrated probing project tasks to determine the extent that existing radiological, chemical, and physical hazards may potentially impact task-site personnel

- Establish the necessary monitoring and sampling required to continuously evaluate exposure and contamination levels and determine adequate ALs to mitigate potential exposures and provide specific actions to be followed if ALs are reached

- Provide mitigating measures through (1) the use of engineering controls, (2) isolation methods for TRU mixed-waste contamination from personnel, (3) work practices to limit personnel exposure, administrative controls, and (4) appropriate respiratory protection and protective clothing to protect task-site personnel from hazards.

8.1 Site Activities Hazards

Personnel may be exposed to safety hazards, or chemical, radiological, and physical agents while working at OU 7-13/14 integrated probing project sites. Potential hazard contributors include (1) buried waste in Pits 4, 6, 9, and 10, (2) historical detection of chemical and radiological soil contamination, (3) radiation fields from exposing buried waste from these pits, and (4) potential "shine" from adjacent waste pits, trenches or logging sources. In addition, use of the drill rig and logging equipment in the EZ of the investigated pit will present direct physical hazards to workers. The magnitude of these hazards to personnel entering the work zones is dependent on both the chemical and radiological nature of the contaminants encountered and the tasks being performed. Engineering controls will be implemented (whenever possible) along with procedural work practices, real-time monitoring of contaminants, and site-specific hazard training to further mitigate potential exposures and hazards.

The greatest exposure and hazard potential is from intrusive operations in the SDA (probe installation) and sampling of Type-B probes where vapor and water samples are brought to the surface inside a glove bag. All cardboard and wood boxes, and approximately 70% of all metal drums, are breached and no longer provide an adequate layer of waste confinement based on past studies in the SDA. Flooding also is assumed to have occurred (McKinley and McKinney 1978).

Pits 4 and 10 were selected because available information indicates that they probably contain the contaminants identified as risk drivers (INEEL 2000c). Pit 6 was selected as an alternative pit to investigate for the same reason. Based on soil-gas survey data, the east end of Pit 4 has the highest organic vapor concentrations. Pit 10 corresponds to one of the areas with high soil gas concentrations and received waste shipments containing uranium, plutonium, and americium. The exact number and placement of probeholes is addressed in the *OU 7-13/14 Plan for the Installation and Logging of Probeholes in Pits 4 and 10 of the Subsurface Disposal Area* (Becker et al. 2000).

- Table 8-1 summarizes each primary task and the associated hazards and mitigation.

- Table 8-2 lists the dominant radiological contaminants buried in the respective pits that may be encountered during the project tasks.

- Table 8-3 lists the dominant nonradiological contaminants buried in the respective pits that present highest health hazards based on potential quantity of material present.

- Table 8-4 presents an evaluation of these radiological and nonradiological contaminants relative to potential routes of exposure and symptoms of overexposure. In Addition, the exposure potential by all routes stated is based on the quantity of material present, toxicity, distribution of containers in the pit, known migration from containers, and the likely matrix to be encountered during sampling tasks (the tasks with the highest potential of exposure).

- Table 8-5 lists hazards (radiological and nonradiological) to be monitored by the IH and RadCon personnel

- Table 8-6 lists IH and RadCon equipment available to monitor these hazards.

- Table 8-7 presents ALs and associated responses for specific hazards.

Engineering and administrative controls, specialized training, worker personal protective clothing strategies, personnel monitoring, and restricted access to designated work areas will form the basic protective measures to eliminate or minimize hazards present at the OU 7-13/14 task sites. Several of the nonradiological contaminants listed (e.g., asbestos, cadmium) have extremely low TLVs based on airborne exposure to these inorganic substances in their pure form. The release potential from these contaminants is considered low because of (1) the nature of the matrix in which they exist (i.e., sludge, moist soil), (2) the mixing action that occurred during flooding and subsidence, (3) the Type B porous stainless steel pore size, and (4) the manner in which samples will be collected (vapor and water form).

OU 7-13/14 integrated probing activities involve known radiological hazards. Because of these hazards, it has been determined that an RWP, according to the MCP-7, "Radiological Work Permit"(INEEL 2002), will be required for all probe installation, logging, and sampling activities. To evaluate potential airborne radiological exposures, RadCon will use existing EDFs, in accordance with MCP-6, "Engineering Design File" (INEEL 2002), and MCP-352, "Determining Radiological Monitoring Requirements" (INEEL 2000).

To address hazardous and radiological conditions at the project site, safety and health professionals may use SWPs, RWPs, and JSA in conjunction with this HASP, as deemed appropriate. These permits hrther detail specialized protective equipment and dosimetry requirements. The IH and radiological monitoring are outlined in Subsections 8.4.1 and 8.4.2, respectively.

Table 8-1. OU 7-13/14 integrated probing project activities. associated hazards. and mitigation.

Activitv or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Mobilization and site preparation (Drill rig truck, logging truck, trailers, hydraulic line, and all support equipment)	• Radiological contamination—SDA subsurface soils • Radiation exposure—SDA near waste shipments from Pit 17 • Chemical/inorganic contaminants—SDA subsurface soil • Equipment movement/vehicle traffic—trailers, drill-rig, or logging truck pinch points; ergonomic concerns; and struck-by or caught-between potential • Lifting and back strain—moving hydraulic line, staging drilling materials • Subsidence of soil from heavy equipment—on or near SDA Pits (seasonal). • Heat and cold stress • Tripping hazards/working-walking surfaces—existing probes in ground, ice and snow-covered surfaces, drill-rig truck deck/ladders • Stored energy sources—electrical lines and panels, elevated materials, hoisting and rigging, gas cylinders (P_{10}).	• RCT surveys, RWP (as required), dosimetry, direct reading instruments, comply with posted entry/exit requirements to SDA and project areas • Controlled areas, qualified operators, JSAs, SWP, TPRs or work package • Mechanical equipment movement, proper lifting techniques, two-person lifts • Trained operators, JSAs, SWPs, TPRs, qualified HEO (hoisting/rigging), coordination through RWMC shift desk before work • IH monitoring, work-rest cycles (as required) • Awareness of probe locations, salt/sand icy areas, use of nonskid/high fiction materials on walking surfaces • Identify and mark all utilities, ensure all lines/cord checked for damage/continuity, GFCI usage on outdoor equipment, comply with minimum clearances for overhead lines, secure cylinders/caps bottles before movement.
Soil gas surveys and surface geophysical mapping	• Radiological contamination—SDA subsurface soils • Radiation exposure— SDA near waste shipments from Pit 17 • Chemical or inorganic contaminants—SDA subsurface soils • Equipment movement and vehicle traffic—pinch points and struck-by and caught-between potential • Lifting and back strain—staging materials, lifting carts • Heat and cold stress • Tripping hazards and working-walking surfaces—existing probes in ground, ice and snow-covered surfaces.	• RCT surveys, RWP (as required), dosimetry, direct reading instruments, comply with posted entry/exit requirements to SDA and project areas • Controlled areas, qualified operators, JSAs, SWP, TPRs or work package • Coordination through RWMC shift desk before work • Proper lifting techniques, two-person lifts (as required) • IH monitoring, work-rest cycles (as required) • Awareness of probe locations, salt/sand icy areas, use of high friction footwear on walking surfaces

Table 8-1. (continued)

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Probehole installation (Type A and Type B); testing of Type-B probes at CTP; downhole logging, overburden screening	• Radiological contaminants—SDA subsurface waste • Radiation exposure— logging source or neutron generator, potential shine from SDA waste material (Type-B probes) • Chemical/inorganic contaminants—SDA subsurface soil and waste, paint, diesel fuel, hydraulic fluid, oil o Equipment movement and vehicle traffic—drill-rig truck, logging truck, forklift, pinch points, ergonomic concerns, and struck-by or caught-between potential o Lifting and back strain—drill string and case handling and tripod assembly setup • Hazardous noise levels—open drill rig engine panel. • Heat/cold stress • Tripping hazards and working-walking surfaces—existing probes in ground, ice and snow-covered surfaces.	• RCT surveys, dosimetry, CAMs, hold points, logging procedures, interlock (neutron generator), source storage cask, HEPA filtered airhood around casing • Controlled work areas, qualified operators, JSAs, SWPs, TPRs, PLNs, or work package and implementation of MCP-138 • MSDS for chemicals on site, IH monitoring, PPE • Casing storage at waist level, proper lifting techniques, two or three person lifts (probe casing) • JSAs, SWPs, TPRs, and logging engineer, and coordination through RWMC shift desk before work • Noise surveys and hearing protection (as required) • IH monitoring, work-rest cycles (as required) • Awareness of probe locations, salt and sand icy areas, use of high fiction footwear on walking surfaces.
Sampling and data collection from installed, Type-B probes, tomography	o Radiological Contaminants—water and vapor samples, glove bag operations o Radiation exposure—from potential contamination encountered, waste shipments from Pit 17 operations o Chemical and inorganic contaminants—sample preservation, argon gas o Lifting and back strain—data transmitter and acquisition equipment, glove bag assembly o Heat and cold stress o Tripping hazards and working-walking surfaces—existing probes in ground, ice and snow covered surfaces.	• RCT surveys, dosimetry, direct reading instruments, HEPA filtered glove bag, glove bag training • Controlled areas, qualified operators, JSAs, SWPs, TPRs. or work package • Wear proper PPE for handling acids, proper handling of gas cylinders • Proper lifting techniques, two-person lifts • JSAs, SWPs, TPRs, coordination through RWMC shift desk before work • IH monitoring, work-rest cycles (as required) • Awareness of probe locations, salt and sand icy areas, use of high fiction footwear on walking surfaces.

CAM = constant air monitor
GFCI = ground fault circuit interrupter
HEO = heavy equipment operator
HEPA = high-efficiency particulate air
IH = industrial hygienist
JSA = job safety analysis
MCP = management control procedure
MSDS = material safety data sheet
PLN = plan
PPE = personal protective equipment
RCT = radiological control technician
RWMC = Radioactive Waste Management Complex
RWP = radiological work permit
SDA = Subsurface Disposal Area
SWP = state work permit
TPR = Technical Progress Review
TPR =technical procedure

Table 8-2. Dominant radiological contaminants of concern at Pits 4, 6, 9, and 10 project sites.[a,b]

Isotope	Estimated Activity in Pit 4 (Ci)	Corresponding Mass (g)	Estimated Activity in Pit 6 (Ci)	Corresponding Mass (g)	Estimated Activity in Pit 9 (Ci)	Corresponding Mass (g)	Estimated Activity in Pit 10 (Ci)	Corresponding Mass (g)
U-234	3.18E-00	5.14E+02	1.31E-00	2.12E+04	8.23E-02	1.32E+01	6.17E-00	9.97E+02
U-235	4.99E-01	2.33E+05	7.32E-02	3.42E+04	3.75E-03	1.73E+03	4.44E-01	2.07E+05
U-238	6.47E-00	1.94E+07	2.94E-00	8.83E+06	3.97E+00	1.18E+07	8.44E-00	2.53E+07
Pu-238	4.33E+02	2.51E+01	4.74E+01	2.59E+00	2.44E+01	1.49E+00	1.75E+02	1.02E+01
Pu-239	9.51E+03	1.52E+05	1.58E+03	2.53E+04	1.16E+03	1.87E+04	5.69E+03	9.10E+04
Pu-240	2.19E+03	9.46E+03	3.53E+02	1.55E+03	2.65E+02	1.17E+03	1.27E+03	5.59E+03
Pu-241	5.72E+04	5.72E+02	9.53E+03	9.53E+01	2.93E+03	2.84E+01	3.49E+04	3.49E+02
Pu-242	1.31E-02	3.33E+00	2.14E-02	5.43E+00	1.26E-02	3.20E+00	7.68E-02	1.95E+01
Am-241	2.2E+04	6.39E+03	3.66E+03	1.06E+03	2.26E+03	6.59E+02	1.33E+04	3.86E+03
Np-237	1.31E-01	1.86E+02	1.38E-02	1.96E+01	---	---	1.76E-01	2.49E+02
Co-60	1.25E+05	1.10E+02	3.42E+04	3.02E+01	5.11E-04	4.52E-07	2.25E+05	1.99E+02
Cs-137 (MAP)"	2.8E+04	3.24E+02	5.93E+03	6.85E+01	2.57E+00	2.97E-02	3.98E+04	4.60E+02
Sr-90 (MFP)[d]	1.7E+04	1.22E+02	5.52E+03	3.97E+01	2.33E+00	1.68E-02	1.84E+04	1.32E+02
Y-90 (MFP)[d]	1.13E+03	2.08E-03	1.23E+03	2.26E-03	2.33E+00	4.29E-06	4.37E+03	8.04E-03

Additional isotopes of concern in other SDA trenches, pits, and soil vault rows, activated beryllium and stainless steel, Ce-141, Co-58, Co-60, Cr-51, Fe-55, H3, Ba-La-140, La-140. Mn-54, Nb-94, Nb-95, Ni-63, Ru-106, Sb-25, Sn-113, Te-I-132, Zn-65, ***MAP,*** and MFP Source terms in these areas were generated from RFP, TRA, NRF, CPP, and other INEEL locations

a. B. H. Becker correspondence (1998). This inventory is not decay-corrected.
b. Nature of the waste when it was buried, radioactive decay, or mixing of container contents is not taken into account.
c. MAPs = mixed activation products.
d. MFPs = mixed fission products.

Table 8-3. Dominant nonradiological contaminants of concern at the Pits 4. 6. 9. and 10 project sites.[a,b]

Chemical or Compound	Estimated Quantity (kg) (in Entire Pit 4)	Estimated Quantity (kg) (in Entire Pit 6)	Estimated Quantity (kg) (in Entire Pit 9)[c,d]	Estimated Quantity (kg) (in Entire Pit 10)
Acetone	7	2	---	5
Aluminum Nitrate Nonahydrate	16,700	6,990	---	13,900
Ammonia	247	0	---	0
Asbestos	15	6	400	13
Benzine	1	0	---	0
Beryllium	406	.004	---	1,270
2-Butanone	2	1	---	3
Butyl alcohol	14	2	---	7
Cadmium	163	2	---	234
Carbon tetrachloride	14,000	14,900	52,000	24,100
Ethyl alcohol	2	1	---	2
Formaldehyde	34	0	---	0
Hydrofluoric acid	654	273	---	542
Lead	50,700	13,100	5,200	49,000
Mercury nitrate monohydrate	71	29	---	58
Methyl alcohol	32	5	---	15
Methylene chloride	2,110	349	150	974
Methyl isobutyl ketone	776	324	---	644
Nitric acid	4,250	1,740	---	3,460
Potassium chloride	764	2,060	2,600	4,620
Potassium nitrate	17,200	46,300	58,000	104,000
Potassium and sodium dichromate (as Cr)	50	162	209	363
Potassium phosphate	382	1,030	---	2,310
Potassium sulfate	764	2,060	---	4,620
Silver	0	0	---	0.4
Sodium chloride	1,530	4,120	5,400	9,250
Sodium nitrate	34,600	92,800	120,000	208,000
Sodium phosphate	764	2,060	2,600	4,620
Sodium sulfate	1,530	4,120		9,250
Sulfuric acid	14	4		8
Terphenyl	118	0		0

Table 8-3. (continued).

Chemical or Compound	Estimated Quantity (kg) (in Entire Pit 4)	Estimated Quantity (kg) (in Entire Pit 6)	Estimated Quantity (kg) (in Entire Pit 9)[c,d]	Estimated Quantity (kg) (in Entire Pit 10)
Tetrachloroethylene	3,030	3,340	19,000	5,370
Toluene	32	0	---	0
Tributyl phosphate	87	36	---	72
1,1,1-Trichloroethane	12,500	12,300	15,000	20,200
1,1,2-Trichloro-1,2,2-rifluoroethane	1,320	218		610
Trichloroethylene	11,800	13,000	17,000	20,900
Trimethylolpropane-triester	39	0	-	0
Uranyl nitrate	20	8	---	16
Xylene	135	12	---	33
Zirconium	4,130	5,710	---	689
Zirconium alloys	415	173	---	504

a. B. H. Becker correspondence (1998).
b. Nature of the waste when it was buried, decomposition of organic materiel, or mixing of container contents is not taken into account.
c. Liekhus (1992).
d. Smith and Kudera (1996) (referenced as an informational document for the evaluation of health and safety concerns only).

Table 8-4. Evaluation of radiological and nonradiological contaminants at the OU 7-13/14 integrated probing project sites.

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[a] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Metals and Inorganic Compounds						
Aluminum nitrate nonahydrate (7784-27-2)	TLV-TWA—2 mg (Al) /m^3	Ih, Ig, S	Severe eye irritation, irritating to mucus membranes and upper respiratory tract, skin irritation.	Behavioral (somnolence), skin and appendages (hair)	No	**Low potential** Distributed in pits and may have migrated from drums. (≈ 16,700 kg in Pit 4) (≈ 6,900 kg in Pit 6) (≈ 13,900 kg in Pit 10)
Ammonia (7664-41-7) VD-0.6 IE-10.18 eV	TWA—17 mg/m^3 STEL—24 mg/m^3	Ih, Ig, Con	Irritation to skin, eyes, and respiratory tract. Toxic by inhalation.	Eyes and respiratory tract	No—NIOSH No—ACGIH	**Low potential** Distributed in Pit 4 and may have migrated from drums. (≈ 247 kg in Pit 4)
Argon Gas (7440-37-1)	None Established	Ih, Con	Extensive tissue damage or burns can result from exposure to liquid argon or cold argon vapors. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, death.	Eyes and skin (frostbite), respiratory system, central nervous system (asphyxiate)	No	**Low potential** Will be used as a carrier gas for Type-B probe gas sample analysis and used to pressurize line for collection of Type-B probe water samples (inside glove bag).

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Asbestos (12001-29-5) VI—NA	TLV—0.2 fiber/cc PEL—0 .2 fiber/cc (29 CFR 1910.1101)	Ih, Ig, Con	Irritation of eyes and skin, chronic asbestosis, restricted pulmonary function.	Eyes and respiratory tract	A1—ACGIH Yes—NTP Yes—IARC Yes—OSHA	**Low potential** Source from pipe insulation and ACBM. Airborne release fraction would be nominal to low, due to matrix (wetted). (≈ 15kg in Pit 4) (≈ 6 kg in Pit 6) (≈ 40 kg Pit 9) (≈ 13kg in Pit 10)
Beryllium (7440-41-7) VI—NA	TLV—0 ,002 mg/m^3 ceiling—0.005 mg/m^3	Ih, Ig, Con	Respiratory, eyes, dermis, chest pain (chronic-berylliosis)	Eyes/Respiratory tract, skin	Yes—NTP Yes—IARC No—OSHA	**Low potential** Distributed in drums containing Series 740 sludge from RFP. (≈ 406 kg in Pit 4) (≈ 4 kg in Pit 6) (≈ .2 kg Pit 9) (≈ 1,270kg in Pit 10).
Cadmium (7440-43-9) VI—NA	TLV—0 .01 mg/m^3* TLV—0.002 mg/m^3** PEL—0 ,005 mg/m^3 (29 CFR 1910.1027) * - inhalable fraction ** - respirable fraction	Ih, Ig	Respiratory, nervous system, irritation of mucous membranes, dryness of mouth, headache	Kidneys/ respiratory tract, blood, prostate	Yes—NTP Yes—IARC A2—ACGIH Yes—OSHA	**Low potential** Numerous trace sources added during several shipments. (≈ 163kg in Pit 4) (≈ 2 kg in Pit 6) (≈ 540 kg Pit 9) (≈ 234 kg in Pit 10)
Hydrofluoric acid (7664-39-3) VI-0.7 IE-15.98 eV	TWA—3 ppm (2.5 mg/m^3) TWA-PEL—3 ppm (2.5 mg/m^3)	Ih, Ig, S, Con	Irritation eyes, skin, nose, throat; pulmonary edema; eye, skin burns; rhinitis; bronchitis; bone changes	Eyes, skin, respiratory system, bones	No—NIOSH No—ACGIH	**Low potential** Distributed in the pits and may have migrated from drums. (≈ 654 kg Pit 4) (≈ 273 kg Pit 6) (≈ 542 kg Pit 10)

Table 8-4. (continued)

Pit 4, **6,** 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Lead (7439-92-1) VI—NA	TLV—0 .05 mg/m^3 PEL—0 .05 mg/m^3 (29 CFR 1910.1025)	Ih, Ig, Con	Lassitude, weight loss, anemia, nausea, vomiting, paralysis, constipation	GI tract, central nervous system, kidneys, blood, gingival tissue	No	**Low potential** Sources include shielding, aprons, gloves, and uncemented sludge. (≈ 50,700 kg Pit 4) (≈ 13,100 kg Pit **6)** (≈ 5,200 kg Pit 9) (≈ 49,000 kg Pit 10)
Lithium oxide (12057-24-8) VI–NA	None established	Ih, Ig, Con	Corrosive to eyes, skin, nose and throat	Skin and eyes (corrosive)	No	**Low potential** Source is from discharging lithium batteries. (trace only--Pit 9)
Mercury (7439-93-2) VD-1.01	TLV—0.025 mg/M^3	S, Ih	Coughing, chest pain, respiratory distress, salivation, diarrhea, depression, irritability	Skin, eyes, respiratory central nervous system, kidneys	No	**Low potential** Five waste streams were added during four separate shipments. (≈ 10 kg in Pit 9)
Mercury nitrate Monohydrate (7783-34-8)	TLV-TWA— 0.025 mg (Hg) /m^3	S, Ih	Extremely destructive to mucus membrane, upper respiratory tract, eyes and skin. Burning sensation, coughing, wheezing, laryngitis, short breath, headache, nausea, vomiting.	Skin, kidneys, GI system nerves, blood	No	**Low potential** Distributed in the pits and may have migrated from drums. (≈ 71 kg Pit 4) (≈ 29 kg Pit **6)** (≈ 58 kg Pit 10)

Table 8-4. (continued).

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Nitric acid (7697-37-2) VD-2 to 3 IE-11.95 eV	ACGIH TWA—2 ppm STEL—4 ppm OSHA	Ih, Ig, Con	Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion	Eyes, skin, respiratory system, teeth	No	**Moderate-high potential** To be used for Type B water sample preservation. Distributed in the pits and may have migrated from the drums. (≈ 4,250 kg Pit 4) (≈ 1,740 kg Pit 6) (≈ 3,460 kg Pit 10)
Potassium chloride (7447-40-7) VD-NA	None established	Ih, Ig, Con	Eyes, irritation of mucous membranes	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 764 kg Pit 4) (≈ 2,060 kg Pit 6) (≈ 2,600 kg Pit 9) (≈ 4,620 kg Pit 10)
Potassium &chromate (7778-50-9) VD-10	TLV—0.05 mg/m^3* *chromate	Ih, Ig, Con	Respiratory, eyes, dermis, skin irritation, discoloration, mucous membrane ulcerating, perforated septum	Skin	Yes—NPT Yes—IARC No—Z List No—OSHA	**Low potential** Drums containing Series 740 evaporator salt distributed in the pit. High pH matrix increases $K_2Cr_2O_7$ potential. (≈ 22 kg Pit 4) (≈ 59 kg Pit 6) (≈ 95 kg Pit 9) (≈ 32 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Potassium nitrate (7757-79-1) VD – 3	None established	Ih, Ig, Con	Respiratory irritation, (Ig—GI pain, nausea and vomiting)	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 17,200 kg Pit 4) (≈ 46,300 kg Pit 6) (≈ 58,000 kg Pit 9) (≈ 104,000 kg Pit 10)
Potassium phosphate (7778-77-0) VD-NA	None established	Ih, Ig, Con	Eyes, minor skin irritation	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 382 kg Pit 4) (≈ 1,030 kg Pit 6) (≈ 1,400 kg Pit 9) (≈ 2,310 kg Pit 10)
Potassium sulfate (7778-80-5) VD-NA	None established	Ih, Ig	None identified	None identified	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 764 kg Pit 4) (≈ 2,060 kg Pit 6) (≈ 2,600 kg Pit 9) (≈ 4,620 kg Pit 10)
Silver (7440-22-4) VD-NA	TLV—0 .01 mg/m^3	Ih, Ig, Con	Respiratory irritation, blue-gray eyes, skin-irritation and ulceration, GI distention	Nasal septum, skin, eyes	No	**Low potential** Only trace amount in Pit 10, distributed during several shipments. (≈ 1 g Pit 9) (≈ 0.4 kg in Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Sodium chloride (7647-14-5) VP-NA	None established	Ih, Ig, Con	Eyes, irritation of mucous membranes	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 1,530 kg Pit 4) (≈ 4,120 kg Pit 6) (≈ 5,400 kg Pit 9) (≈ 9,250 kg Pit 10)
Sodium &chromate (10588-01-9) VD-10	TLV—0.05 mg/m^3 * * Chromate	Ih, Ig, Con	Respiratory, eyes, skin irritation or ulcerating	Kidneys, liver	Yes—NPT* Yes—IARC* Yes—Z List* Yes- OSHA* *chromium	**Low potential** Drums containing Series 740 evaporator salt distributed in the pit. High pH matrix increases $Na_2Cr_2O_7$ potential. (≈ 38 kg Pit 4) (≈ 103 kg Pit 6) (≈ 200 kg Pit 9) (≈ 231 kg Pit 10)
Sodium nitrate (7631-99-4) VD-2.9	None established	Ih, Ig, Con	Respiratory, eyes, dermis, (Ih and Ig may cause cyanosis)	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP (≈ 34,600 kg Pit 4) (≈ 92,800 kg Pit 6) (≈ 120,000 kg Pit 9) (≈ 208,000 kg Pit 10)
Sodium phosphate (7558-79-4) VD-4.9	None established	Ih, Ig, Con	Respiratory, eyes, dermis	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 764 kg Pit 4) (≈ 2,060 kg Pit 6) (≈ 2,600 kg Pit 9) (≈ 4,620 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[c] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Sodium sulfate (7757-82-6) VD-NA	None established	Ih, Ig, Con	Respiratory, eyes, dermis	None identified, primarily a localized irritant	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 1,530 kg Pit 4) (≈ 4,120 kg Pit 6) (≈ 5,400 kg Pit 9) (≈ 9,250 kg Pit 10)
Sulfuric acid (7664-93-9) VD-3.4 IE-	ACGIH TWA—1 mg/m^3 STEL—3 mg/m^3	Ih, Ig, Con	Irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; tracheobronchitis; eye, skin burns; dermatitis	Eyes, skin, respiratory system, teeth	No	**Low potential** Distributed in the drums containing Series 740 sludge from RFP. (≈ 14 kg Pit 4) (≈ 4 kg Pit 6) (≈ 8 kg Pit 10)
Uranium—insoluble compounds, as U (7440-61-1) (metal) VD-NA IE	TWA—0.2 mg/m^3 STEL—0.06 mg/m^3 OSHA PEL-TWA—0.25 mg/m^3	Ih, Ig, Con	Dermatitis; kidney damage; blood changes; (potential occupational carcinogen); in animals; lung, lymph node damage.	Skin, kidneys. bone marrow, lymphatic system, lung cancer	YES—NIOSH (potential)	**Moderate potential** Distributed in the pits. Most is in solid non-soluble form, from metals, filters, trash salt cakes, and scrap. U-238 is the uranium isotope of most concern. (See Table 8-2 for U-234, 236). For U-238: (≈ 1.94E+04 kg Pit 4) (≈ 8.83E+03 kg Pit 6) (≈ 2.53E+04 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[c] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Uranium—soluble compounds, as U (none) VD- IE-	TWA—0.05 mg/m^3	Ih Ig, Con	Dermatitis; kidney damage; blood changes; potential occupational carcinogen (in animals); lung, lymph node damage.	Skin, kidneys, bone marrow, lymphatic system, lung cancer	YES—NIOSH (potential)	**Low potential** Most is in solid, non-soluble form, from metals, filters, trash salt cakes, and scrap. A **small percent** of the U-235 could be soluble. Total U-235: (≈ 233 kg Pit 4) (≈ 34 kg Pit 6) (≈ 207 kg Pit 10)
Uranyl nitrate (13520-83-7)	PEL—0.05 mg (U)/m^3	Ig, Ih, S	Irritation to eyes, mucus membrane, and upper respiratory tract. May be fatal if swallowed.	Liver, kidneys, lungs, brain	Yes—California Proposition 65	**Low potential** Distributed in pits and may have migrated from drums. (≈ 20 kg Pit 4) (≈ 8 kg Pit 6) (≈ 16kg Pit 10)
Zirconium/ Zr-compounds (7440-67-7) VD-NA	TLV—5 mg/m^3 Ceiling-10 mg/m^3	Ih, Con	Respiratory, irritation of skin and mucous membranes, lung granulomas.	Respiratory system, skin	No	**Low potential** Source is from scrap metal. (≈ 4,545 kg Pit 4) (≈ 5,883 kg Pit 6) (≈ 12 m^3 in Pit 9) (≈ 1,193kg Pit 10)
Organic Compounds						
Acetone (67-64-1) VD-2 IE-9.7 eV	TLV-500 ppm STEL-750 ppm Ceiling-1782 ppm	Ih, Ig, Con	Nervous system, respiratory, dermis, headache, contact with eyes may cause permanent damage.	Respiratory system, skin	No	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 7 kg Pit 4) (≈ 2 kg Pit 6) (≈ 44 g Pit 9) (≈ 5 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[a] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Benzine (VM + P Naptha) (8032-32-4)	ACGIH TLV—1370 mg/m^3 CL—1800 mg/m^3 15 min.	S, Ih, Ig, Con	Wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting, coughing, burning sensations.	Central nervous system, skin, lungs	ACGIH Animal carcinogen	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 1 kg Pit 4) (≈ 2 kg Pit 6) (≈ 5 kg Pit 10)
2-Butanone (78-93-3) VD-2.5 IE-9.54 eV	TWA—200 ppm STEL—300 ppm	Ih, Ig, Con	Irritation of eyes, skin, nose; headache; dizziness; vomiting; dermatitis.	Eyes, skin, respiratory system, lungs, central nervous system	No-NIOSH No-ACGIH	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 2 kg Pit 4) (≈ 1 kg Pit 6) (≈ 3 kg Pit 10)
Butyl Alcohol (71-36-3) VD-2.55 IE-10.4 eV	STEL C—50 ppm* Ceiling—152 ppm* (Ceiling for both)* *n-Butanol	Ih, Ig, S, Con	Nervous system, respiratory, dermis, headache, shortness of breath.	Respiratory system, eyes, skin	No	**Low potential** Source from uncemented sludge. (≈ 14 kg Pit 4) (≈ 2 kg Pit 6) (≈ 1.2 kg Pit 9) (≈ 7 kg Pit 10
Carbon tetrachloride (56-23-5) VD-5.3 IE-11.5 eV	TLV—5 ppm STEL—10 ppm Ceiling—63 ppm	Ih, Ig, S, Con	Nervous system, eyes, respiratory, irritation of eyes and skin; central nervous system depression, headache.	Central nervous system, eyes, liver, lungs, kidneys	A2—ACGIH Yes—NTP Yes—IARC No—OSHA	**Moderate-high potential** Widely distributed in pits and probably has migrated from drums. (≈ 14,000 kg Pit 4) (≈ 14,900 kg Pit 6) (≈ 52,000 kg Pit 9) (≈ 24,100 kg Pit 10)
Diesel fuel (8008-20-6) VD->1	100 mg/m^3 (diesel fuel/kerosene - ACGIH notice of intended changes for 2000)	Ih, Ig, S, Con	Nervous system, eyes, respiratory, dermis, headache, skin irritation.	Skin	No	**Moderate potential** Will be used to refuel equipment.

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[a] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Ethyl alcohol (64-17-5) VD- IE-10.47 eV	ACGIH TLV-TWA—1000 ppm (1880 mg/m^3)	Ih, Ig, S, Con	Irritation eyes, skin, nose; headache, drowsiness, fatigue, narcosis; cough; liver damage; anemia; reproductive, teratogenic effects.	Eyes, skin, respiratory system, central nervous system, liver, blood, reproductive system	No-ACGIH	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 2 kg Pit 4) (≈ 1 kg Pit 6) (≈ 2 kg Pit 10)
Formaldehyde (50-00-0) VD-1.07 IE-10.88 eV	ACGIH TLV—0.37 mg/m^3 (0.3 ppm) OSHA (29 CFR 1910.1048) PEL-TWA —0.75 ppm STEL—2 ppm	Ih, Ig, S, Con	Irritation eyes, nose, throat, respiratory system; lacrimation (discharge of tears); cough; bronchitis spasm, dermatitis.	Eyes, skin, respiratory system, cancer, kidneys, liver, heart, nasal cancer	Yes-NIOSH Yes-ACGIH Yes-OSHA	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 34 kg Pit 4) (≈ 0 kg Pit 6) (≈ 0 kg Pit 10)
Methyl alcohol (67-56-1) VD-1.11 IE-10.8 eV	TLV—200 ppm STEL—250 ppm Ceiling—328 ppm	Ih, Ig, S, Con	Nervous system, eyes, respiratory, central nervous system depression, (contact with eyes may cause temporary corneal damage).	Eyes, skin, central nervous system	No	**Low potential** Source from uncemented sludge. (≈ 32 kg Pit 4) (≈ 5 kg Pit 6) (≈ 2.6 kg Pit 9) (≈ 15 kg Pit 10)
Methylene chloride (75-09-2) VD-2.9 IE-11.3 eV	TLV—50 ppm OSHA (29 CFR 1910.1052) TWA - 25 ppm STEL – 125 ppm	Ih, Ig, Con	Headache, dizziness, skin irritation.	Skin, central nervous system, eyes, cardiovascular system	No	**Moderate potential** Distributed throughout the pits. (≈ 2,110 kg Pit 4) (≈ 349 kg Pit 6) (≈ 150 kg Pit 9) (≈ 974 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Methyl Isobutyl Ketone (563-80-4) VD- IE-9.32 eV	TWA—200 ppm (705 mg/m^3) PEL—None	Ih, Ig, Con	Irritation eyes, skin, mucous membrane, respiratory system; cough.	Eyes, skin, respiratory system	No	**Moderate potential** Distributed throughout the pits. (≈ 776 kg Pit 4) (≈ 324 kg Pit 6) (≈ 644 kg Pit 10)
Nitric Acid (7697-37-2) VD-2 to 3 IE-11.95eV	ACGIH TWA—2 pprn STIEL—4 pprn	Ih, Ig, Con	Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion.	Eyes, skin, respiratory system, teeth	No	**Low potential** Distributed in the pits and may have migrated from the drums. (≈ 4,250 kg Pit 4) (≈ 3,460 kg Pit 10) Will be used for water sample preservation.
Nitrocellulose (111-76-2) VD->1	TLV—25 ppm * *(2-butoxyethanol)	Ih, Ig, S	Nervous system, respiratory, dermis, central nervous system, eyes.	Skin, liver, kidney, blood	No	**Low potential** Drums distributed throughout Pit 9. (≈ 90 g per drum)
PCBs (11097-69-1) VD-3	TLV—0.5 mg/M^3* *(54% chlorine)	Ih, Ig, S, Con	Respiratory, nervous system, central nervous system depression, dermis, eyes, headache.	Skin, kidney, liver, central nervous system	Yes-NTP Yes-IARC No-OSHA	**Low potential** Series 743 contaminated oil source contained with only trace amounts. (≈ 266 g in Pit 9)
Terphenyl (o-, m-, p-) (84-15-1, 92-06-8, 92-94-4) VD-NA IE- 7.78—8.01 eV	ACGIH Ceiling—0.5 ppm (5 mg/m^3) OSHA Ceiling—1 ppm (9 mg/m^3)	Ih, Ig, Con	Irritation eyes, skin, mucous membrane; thermal skin burns; headache; sore throat; in animals: liver, kidney damage.	Eyes, skin, respiratory system, liver, kidneys	No	**Low potential** Distributed in Pit 4. (≈ 118 kg Pit 4) (≈ 0 kg Pit 6) (≈ 0 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Tetrachloroethylene (127-18-4) VD-5.8 IE-9.3 eV	TLV—25 ppm STEL—100 ppm Ceiling—685 ppm	Ih, Ig, Con	Nervous system, respiratory, headache, loss of consciousness, dermis.	Liver, kidneys, eyes, upper respiratory, central nervous system	No	**Moderate-high potential** Widely distributed in pits and may have migrated from drums. (≈ 3,030 kg in Pit 4) (≈ 3,340 kg Pit 6) (≈ 19,000 kg Pit 9) (≈ 5,370 kg Pit 10)
Toluene (108-88-3) VD-3.14 IE- 8.82 eV	ACGIH WA= 50 ppm (188 mg/m^3) NIOSH TWA—100 ppm (375 mg/m^3) STEL—150 ppm (560 mg/m^3) Ceiling—200 ppm (10 min) OSHA PEL-TWA—200 ppm Ceiling—300 ppm and 500 ppm (10 min peak during 8-hr shift)	Ih, S, Ig, Con	Irritation eyes, nose; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); nervousness, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.	Eyes, skin, respiratory system, central nervous system, liver, kidneys, bladder, blood	No	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 32 kg Pit 4) (≈ 0 kg Pit 6) (≈ 0 kg Pit 10)
Tributyl phosphate (126-73-8) VD-NA IE-	NIOSH TWA—0.2 ppm (2.2 mg/m^3) OSHA PEL-TWA—0.4 ppm (5 mg/m^3)	Ih, Ig, S Con	Irritation eyes, skin, respiratory system, headache, nausea.	Eyes, skin, respiratory system, central nervous system, blood	No	**Low potential** Absorbed on rags in waste in numerous shipments. (≈ 87 kg Pit 4) (≈ 36 kg Pit 6) (≈ 72 kg Pit 10)

Table 8-4. (continued).

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[a] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
1,1,1-Trichloroethane (71-55-6) VD-4.6 IE-11.1 eV	TLV—350 ppm STEL—450 ppm Ceiling—2460 ppm	Ih, Ig, S, Con	Nervous system, dermis, respiratory, eyes, central nervous system depression, headache.	Central nervous system, skin, eyes, cardiovascular system	No	**Moderate-High potential** Widely distributed in pits and may have migrated from drums. (≈ 12,500 kg Pit 4) (≈ 12,300 kg Pit 6) (≈ 15,000 kg Pit 9) (≈ 20,200 kg Pit 10)
Trichloroethylene (79-01-6) VD-4.53 IE-9.5 eV	TLV—50 ppm STEL—100 ppm Ceiling—537 ppm	Ih, Ig, Con	Nervous system, headache, respiratory, eyes, pulmonary edema.	Respiratory, heart, liver, kidneys, central nervous system	No	**Moderate-High potential** Widely distributed in pits and may have migrated from drums. (≈ 11,800 kg Pit 4) (≈ 13,000 kg Pit 6) (≈ 17,000 kg Pit 9) (≈ 20,900 kg Pit 10)
1,1,2-Trichloro-1,2,2-Trifluoroethane (76-13-1) VD-6.5 IE-11.99 eV	TWA—1000 ppm (7,600 mg/m^3) STEL—1250 ppm (9,500 mg/m^3)	Ih, Ig, Con	Irritation skin, throat, drowsiness, dermatitis; central nervous system depressant and depression (in animals); cardiac arrhythmia, narcosis.	Skin, heart, central nervous system cardiovascular system	No	**Low potential** Distributed in pits and may have migrated from drums. (≈ 1,320 kg Pit 4) (≈ 218 kg Pit 6) (≈ 610 kg Pit 10)
Trimethylolpropane-triester (Triacrylate) (15625-89-5)	None listed.	Ih, S, Ig	Irritation to eyes, mucus membrane and upper respiratory tract. Causes skin irritation.	Mucus membranes, upper respiratory tract, skin.	Not listed	**Low potential** Distributed in Pit 4 and may have migrated from drums. (≈ 135 kg Pit 4) (≈ 12 kg Pit 6) (≈ 33 kg Pit 10)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit" (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure" (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Xylene (95-47-6) VD-5.2 IE-8.6 eV	TLV—100 ppm STEL—150 ppm Ceiling—65 1 ppm	Ih, Ig, S, Con	Nervous system, respiratory, dermis, eyes, headache, drowsiness.	Central nervous system, eyes, skin, GI tract, blood, liver, kidneys	No	**Low potential** Source from uncemented sludge. (≈ 135 kg Pit 4) (≈ 12 kg Pit 6) (≈ 5.6 kg Pit 9) (≈ 33 kg Pit 10)
Versenes (EDTA) (60-00-4) VD-NA	Not established	Ih, Ig, Con	Eyes, respiratory.	Respiratory system, eyes, GI tract	No	**Low-moderate potential** Distributed among (4,016) Series-745 sludge drums (≈ 280 kg in Pit 9)
Radionuclides—As listed on Table 8-2, **neutron logging source, and neutron generator).**						
Radiological Contaminant						**Expected Levels**
Radionuclides (whole-body exposure)	INEEL—1.5 rem/yr project ALARA dose limit-per RWP or ALARA Task Posting of radiation areas per INEEL RCM, Table 2-3	Whole Body	Electronic dosimetry will be used to alert workers to increased gamma radiation fields. Albedo dosimetry and NRD instruments will be used to monitor for neutron radiation.	Blood forming cells, GI tract, and rapidly dividing cells	Yes	**Low-moderate potential** Low doses from repeated handling of logging sources. . Logging source installation and removal from tool/neutron generator (V&V NDA research). (High Radiation Area may be established during logging tasks)

Table 8-4. (continued)

Pit 4, 6, 9, & 10 Material or Chemical (CAS #, Vapor Density and Ionization Energy	Exposure Limit[a] (Permissible Exposure Limit or Threshold-Limit Value)	Routes of Exposure[b]	Symptoms of Over-Exposure[a] (Acute and Chronic)	Target Organs and System	Carcinogen? (Source)[d]	Exposure Potential[e,f] (All Routes Without Regard to Personal Protection Equipment)
Radionuclides (fixed and removable surface contamination)	Posting of CAs per INEEL RCM, Table 2-4, § 835.404.c, and § 835.603.f	Ig, Con	Alarming personnel-contamination monitors and hand-held instruments (see Table 8-6)	GI tract, ionization of internal tissue	Yes	**Low-moderate potential** Contact with contaminated surfaces. Fixed and removable contamination levels not expected to exceed 100 times Table 2-2 values for specific radionuclides.
Radionuclides (airborne radioactivity)	10% of DAC for specific radionuclide selected (10 CFR 835) Posting of airborne radioactivity areas per INEEL RCM, Table 2-4, and 10 CFR 835.603.d	Ih, Ig, Con	Alarming continuous air monitors, portable air samplers, and surface swipe counting (see Table 8-6).	Respiratory system, GI tract, ionization of internal tissue	Yes	**Low potential** Isolated glove bag sampling system. Potential if HEPA system fails. Airborne levels exceeding 10% of specified DAC value possible in localized area if confinement breached.

a. ACGIH 2000 TLV Booklet and OSHA 29 CFR 1910 substance specific standards, and MSDS.

b. (Ih) inhalation; (Ig) ingestion; **(S)** skin absorption; (Con) contact hazard.

c. Nervous system: dizziness, nausea, lightheadedness; Dermis: rashes, itching, redness; Respiratory: respiratory effects; Eyes: tearing, irritation.

d. If yes, identify agency and appropriate designation (ACGIH A1 or ***A2;*** NIOSH; OSHA; IARC; NTP).

e. Personal exposure to personnel from waste constituents when conducting OU 7-13/14 integrated probing project tasks.

f. Estimates (≈) of specific compounds from Tables 8-2 and 8-3

ACGIH = American Conference of Government Industrial Hygienists
CAS=chemical abstract service
CNS = central nervous system
CVS = cardiovascular system
DAC = derived air concentration
eV = electron volts
IARC International Agency for Research on Cancer
IE =-ionization energy
GI = gastrointestinal
MSDS = Material safety data sheets
NIOSH = National Institute for Occupational Safety and Health
NPT Non-Proliferation Treaty
PCB = polychlorinated biphenyl
PEL = permissible exposure limit
OSHA = Occupational Safety and Health Administration
REM = roentgen equivalent man
RCM = radiological control manual
STEL short-term exposure limits
TLV = threshold limit value
TWA = time-weighted average
VD = vapor density (air = 1)

Material safety data sheets for these chemicals are available at the OU 7-13/14 trailer.

Table 8-5. OU 7-13/14 integrated probing project hazards to be monitored.[a]

Task or Activity	Radiological and Nonradiological Hazards to be Monitored
All tasks	Heat and Cold Stress
Mobilization, site preparation, soil gas surveys, and geophysical mapping	Radiological contamination (alpha, beta, gamma) airborne radioactivity (alpha, beta, gamma) radiation fields (beta, gamma) hazards noise levels (heavy equipment)
Probehole installation, downhole logging	Radiological contamination (alpha, beta, gamma) Airborne radioactivity (alpha, beta, gamma) Radiation fields (gamma and neutron) VOCs[b,c] Carbon monoxide (if generator used for supplemental power) Hazards noise levels (heavy equipment)
Type B sampling (if conducted)	Radiological contamination (alpha, beta, gamma) Airborne radioactivity (alpha, beta, gamma) Radiation fields (gamma and neutron) VOCs[b] Chlorinated organic volatile compounds (carbon tetrachloride, 1,1,1-trichloroethane, trichloroethylene, methylene chloride tetrachloroethylene)"

a. Monitoring and sampling will be conducted as deemed appropriate by project industrial hygienist (IH) and RadCon personnel based on specific tasks and site conditions.

b. All volatile organic compounds (VOCs) will be monitored with direct-reading flame ionization detector (FID) or photoionization instrumentation (PID) (lamp eV in accordance with the IH) to provide a single value for comparison to the VOC listed on Table 8-7 (personal protective equipment [PPE] Level C or D only).

c. All chlorinated VOCs will be evaluated with an FID or PID (11.7eV lamp) initially, then detector tubes if levels are suspected to exceed the action limit established for carbon tetrachloride listed on Table 8-7 (PPE Level C or D).

eV = electron volts
FID = flame ionization detector
IH = industrial hygienist
PID = photoionization instrumentation
PPE = personal protective equipment
VOC = volatile organic compound

8.2 Routes of Exposure

Exposure pathways for hazardous materials and radionuclides are directly related to the nature of the project, principally, the probe installation and sampling activities. Engineering controls (glove bag), continuous monitoring, specialized training, and procedural work controls will largely mitigate the potential contact and uptake associated these tasks; however, the potential for exposure exists. Exposure pathways include the following:

- Inhalation of radiologically contaminated organic compounds and fugitive dusts during intrusive probe installation activities and sampling tasks. This contamination form may have trace amounts of inorganic compounds, and be contaminated with radionuclides, resulting in potential lung deposition.

- Skin absorption and contact with radiologically contaminated organic and inorganic compounds during drilling and sampling tasks that can be absorbed through unprotected skin or corrosion resulting in chemical burns, uptake through skin absorption, and/or skin contamination.

Table 8-6. Equipment available to monitor OU 7-13/14 integrated probing project radiological and nonradiological hazards [a].

Chemical or Radiological Hazard to be Monitored or Sampled		
VOCs (listed on Table 8-3) Aromatic VOCs (listed on Table 8-3) Chlorinated VOCs (listed on Table 8-3)	Personal sampling pumps with appropriate media	VOCs—NIOSH 1300, 1400, 2000 Aromatic VOCs—NIOSH 1501 Chlorinated VOCs—NIOSH 1003
VOCs and chlorinated VOCs (screening)		
Chlorinated VOCs (above action limit)	Dreager, or equivalent detector tubes (carbon tetrachloride) – for level D or C PPE only	
CO	MSA-361 or equivalent, with CO cell	
Radiological contamination (alpha)	Count-rate—Bicron/NE Electra (DP-6 or AP-5 probe) or equivalent Stationary-—Eberline RM-25 (HP-380AB or HP-380A probe) or equivalent CAM—ALPHA 6-A-1 (in-line and radial sample heads, pump, RS-485) or equivalent (as required) Grab Sampler—SAIC H-810 or eauivalent	
Radiological contamination (beta and gamma)	Count-rate—Bicron NE/Electra (DP-6, BP-17 probes) or equivalent Stationary-—Eberline RM-25 (HP-360AB probe) or equivalent CAM (beta)—AMS-4 (in-line and radial head, pump RS-485) or equivalent (as required) Grab Sampler—SAIC H-810 or equivalent	
Radiological contamination (general counting)	LB-5100/NFS-RPS counting system or equivalent Alpha/beta scalars protean eauivalent	
Personal contamination monitors		
Radiation (gamma and neutron) fields and Geiger-Mueller (GM) instruments		
Hazardous noise levels (>85 dBA, >140 impact)		
Heat and cold stress	Heat stress—WBGT, body wt, fluid intake	Cold stress—ambient air temp., wind chill charts

a. Air sampling will be conducted as deemed appropriate by project Industrial Hygiene and Radiological Control personnel, based on initial direct-reading instrument data, swipes, and other site factors.

ANSI=American National Standards Institute
CAM=constant air monitor
FID=flame ionization detector
NIOSH=National Institute of Occupational Safety and Health
PCM=personal contamination monitor
PID=photoionization detector
PPE=personal protective equipment
RCIMS=Radiological Control Information Management Systems
SAIC=Science Applications International Coruoration
TWA=time-weighted average
VOC=volatile organic contaminants
WBGT=wet bulb globe test

Table 8-7. Action levels and associated responses for OU 7-13/14 integrated probing project hazards.

Contaminant or Agent Monitored	Action Level		Response Taken if Action Level is Exceeded	
Organic vapors (11.7eV lamp)	<5 ppm in workers' breathing zone		Monitor near source for elevated levels, ensure personnel are on upwind side of source. continue to monitor.	
(Applies only if not in Level C or B respiratory protection)	5-10 ppm sustained for 1 minute in workers' breathing zone		Continue working, pull CCL_4 detector tube sample. If <5 ppm, continue working, periodic monitoring (minimum = every 5 minutes). If >5 ppm, leave area until vapor dissipates, then perform continuous monitoring or don minimum of Level C respiratory protection"and continue working.	
(Applies only if not in Level C respiratory protection)	10–25 ppm in workers' breathing zone		If episodic—leave area until dissipates, perform continuous monitoring, or don minimum Level C respiratory protection and continue working. If sustained—don minimum Level C respiratory protection".	
	25–50 ppm in workers' breathing zone		Evacuate area and don minimum Level C respirator protection", continue periodic monitoring (minimum = every 5 minutes).	
	> 50 ppm in work area		Evacuate area; consult FTL whether to abandon probehole.	
Hazardous noise levels	<85 dBA		No action.	
	85–114 dBA		Hearing protection required to attenuate to below 85 dBA (based device NRR).	
	a. >115 dBA	b. >140 dBA	a. Isolate source; evaluate NRR for single device, double protection as needed.	b. Control entry, isolate source, only approved double protection worn.
Radiation field	<5 mrem/hour		No action. no posting reauired.	
	5-100 mrem/hour @ 30 cm §835.603.b)		Post as "Radiation Area." Required items: RW I or II training, RWP, personal dosimetry.	
	>100 mrem - 500 Rad @ 100 cm (§835.603.b)		Post as "High Radiation Area." Required items: RW II, RWP, alarming personal dosimetry, dose-rate meter, temporary shielding (as required).	
	Exceed RAM alarming set point, if required (fast ringing bell, flashing red light)		Evacuate area immediately, muster at CRZ and await instruction from RadCon.	
Radiological contamination	1–100 times RCM Table 2-2 values (§835.603.d)		Post as "Contamination Area." Required items: RW II training, personal dosimetry, RWP, don PPE, bioassay submittal (as required).	
	> 100 times RCM Table 2-2 values (§835.603.d)		Post as "High Contamination Area." Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).	

Table 8-7. (continued)

Contaminant or Agent Monitored	Action Level	Response Taken if Action Level is Exceeded
Airborne radioactivity	Concentrations (μCi/cc) > 10% of and DAC value (§835.603.d)	Post as "Airborne Radioactivity Area." Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).
	Exceed CAM alarming set point (fast ringing bell, flashing red light)	Evacuate upwind to CRZ; await RadCon.
Any failure of the glove bag or confinement system, or emergency event at OU 7-13/14 integrated probing project sites or RWMC[b]		Evacuate the area. Use emergency shut-off on drill rig. Proceed to an upwind position or assembly area as directed by RCT.

a. Level C respiratory protection will consist of a full-face respirator equipped with a combination multichemical-HEPA cartridge (i.e. MSA, GMC-H) as prescribed by the project IH. See Section 9, "Personal Protective Equipment," for additional Level C requirements.

b. See Section 11 for OU 7-13/14 integrated probing project sites, details specific events and appropriate emergency responses. Any release should be considered an emergency event and require at least an evacuation of the OU 7-13/14 integrated probing project area.

dBA decibel A-weighted CAM constant air monitor CRZ contamination reduction corridor DAC derived air concentration.
RCM radiological control manual NRR noise reduction rating RW radiological worker

- Ingestion of radiologically contaminated organic and inorganic compounds adsorbed to dust particles or waste residues adhering to drilling or sampling equipment leading to potential uptake of contaminants through the gastrointestinal tract that result in gastrointestinal irritation, internal tissue irradiation, and/or deposition to target organs.

- Injection, while handling radiologically contaminated organic and inorganic materials, by breaking of the skin or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

8.3 Environmental and Personnel Monitoring

The potential for exposure to radiological and nonradiological hazards exists during many of the tasks that will take place at OU 7-13/14 integrated probing project sites and affects all personnel who work in the designated work areas. Refinement of work controls zones (see Section 7), engineering and administrative controls, proceduralized work controls, worker training, and the use of protective equipment will eliminate or mitigate most of these hazards. However, given the nature of the intrusive tasks (drilling) and that sample material will be brought from the waste region to the surface (having been filtered through porous stainless steel or HEPA inline filters), monitoring with direct-reading instruments will be conducted to provide RadCon and IH personnel with real-time data to assess the effectiveness of these engineering and work controls.

Type-B probe installation and sampling activities present the greatest potential to encounter buried waste contaminants. The IH and RadCon personnel will focus on these activities and monitor them with direct-reading instrumentation, swipes, and full and partial-period air sampling (as deemed appropriate). Monitoring will be conducted to verify the integrity of Type-B probe components and interface with the sampling glove bag to ensure contamination has not migrated from the isolated lines that are to be used to collect samples, and to verify the effectiveness of decontamination practices (when required).

Personnel working at the OU 7-13/14 integrated probing project site may be exposed to hazardous materials or hazardous physical agents, as already described. Safety hazards and other physical hazards will be monitored and controlled as outlined in Subsection 8.5. The specific hazardous agent exposures that will be monitored are listed in Table 8-5.

8.3.1 Industrial Hygiene Monitoring

Several of the substances listed in Table 8-4 have an American Conference of Government Industrial Hygienists (ACGIH)(1991)-TLV "skin" notation indicating that a potential, significant contribution to the overall exposure may be by the cutaneous route. This includes the mucous membranes and the eyes, either by contact with vapors or, of probable greater significance if permeation or damage to PPE occurs, by direct skin contact with the substance.

Various direct-reading instruments and other semi-quantitative detection tests (detector tubes) will be used at the discretion of the IH to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, and professional judgment. Instruments and sampling methods listed in Table 8-6 will be used by the project IH as deemed appropriate.

All full and partial period airborne contaminant samplings will be conducted using applicable NIOSH or OSHA methods, in conformance to the Manual 14B Safety and Health-Occupational Safety and Fire Protection, (INEEL 2003). Risk assessments for task-site personnel will be conducted according to MCP-153, "Industrial Hygiene Exposure Assessment"(INEEL 2002).

8.3.1.1 Industrial Hygiene Instrument and Equipment Calibration. All monitoring instruments will be maintained and calibrated in accordance with the manufacturer'srecommendations, existing IH protocol, and in conformance to the Manual 14B *Safety and Health-Occupational Health* (INEEL 2003). Direct reading instruments will be calibrated before daily use, at a minimum, and more frequently as determined by the project IH. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded per Subsection 3.1.

8.3.2 Radiological Monitoring

The radiological inventory of the SDA pits includes nuclides that emit alpha, beta, gamma, and neutron forms of ionizing radiation. During OU 7-13/14 integrated probing project tasks, the potential exists for exposure to both external (penetrating ionizing radiation [gamma, neutron, and high-energy beta]) and internal radiation (inhalable, ingestible, or absorbed radioactive contaminants). The greatest potential for external radiation exposure will to personnel in close proximity to the logging sources, neutron generator, or if contamination is encountered. Internal radiological hazards will only be a concern if contamination is encountered and for those personnel in direct contact with the waste constituents that are collected from the Type-B probes (samplers).

Based on the unique and distinctive hazards presented by both external and internal radiation sources, they will be evaluated, controlled, and monitored individually (although the detection of any radionuclides will serve to alert for the presence of both). For purposes of this monitoring section, they will be discussed separately and distinguished by their primary health effects (i.e., radiation [external], contamination [internal]). Radiological monitoring to be conducted at OU 7-13/14 integrated probing project sites may include area airborne equipment and personnel monitoring. When monitoring is conducted, it will be done in accordance with MCP-139 (INEEL 2001), MCP-357, "Job-Specific Air Sampling/Monitoring" (INEEL 2001), and MCP-425 (INEEL 2003), for external radiation hazards include elevated background levels from SDA buried-waste pits, potential "shine" from probes, Pit 17 operations, its, logging neutron generator, and the handling of radioactive sources (calibration and active logging). Because of a variety of potential external radiation sources, a variety of area and personnel monitoring methods will be used. These may include the use of direct-reading radiation detectors (e.g., ion chambers, Geiger-Mueller, and neutron), TLD, albedo (neutron dose from logging source), and electronic dosimetry. This data will be used by RadCon personnel to (1) evaluate the effectiveness of engineering controls and interlocks (neutron generator), (2) ensure radiological area boundaries are adequate, (3) alert project personnel to potential high radiation sources, and (4) ensure the effectiveness of decontamination methods and procedures.

8.3.2.1 Contamination Monitoring. The greatest potential for radioactive contamination will be from the TRU-contributing alpha emitters associated with the SDA buried waste. Alpha contamination is of particular concern because of its mobility, the difficulty in detection, and therefore, ease of cross-contamination. Because of the presence of beta-gamma-emitting radionuclides, beta-gamma-radioactive contamination is also a concern. Contamination monitoring for alpha and beta-gamma-radioactive contamination will be accomplished using extensive direct survey and swipe/counting techniques. Low background alpha-beta counters, located near OU 7-13/14 integrated probing project sites (or in WMF-601), will be used to quantify contamination levels. This data will be used by RadCon personnel to (1) evaluate the effectiveness of engineering controls, (2) ensure radiological area boundaries are adequate, (3) alert project personnel of contaminated equipment or areas, and (4) ensure the effectiveness of personnel and equipment-decontamination procedures (if implemented).

The need for airborne radioactivity sampling will be evaluated per MCP-352 (INEEL 2000), and performed in accordance with MCP-357, "Job-Specific Air Sampling/Monitoring" (INEEL 2001). The nature of the sonic drilling process, as it advances downward, tends to form a stable matrix to "fix"

contaminants and minimize upward migration along the outer surface of the casing; however, air monitoring will be conducted as stated in the RWP. The Type-B probe sampling will be conducted in a confinement glove bag, and contamination monitoring will be conducted during all sampling activities

8.3.2.2 Radiological Instrument and Equipment Calibration. RadCon personnel may use any of the radiation and contamination detectors and counters listed on Table **8-6** to provide radiological information to OU 7-13/14 personnel. Daily operational and performance checks will be performed on all portable survey instruments to ensure they are within the specified baseline calibration limits. Accountable radioactive sources (including any logging sources) will be maintained in accordance with MCP-137 (INEEL 2002). All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations, existing RadCon protocol, and in conformance to MCP-93, "Health Physics Instrumentation" (INEEL 1999), and in accordance with 10 CFR 835.703(d).

8.3.2.4 External Dosimetry. Radiological dosimetry will be required for personnel working on SDA OU 7-13/14 integrated probing project sites. The RWMC requirements state that individuals leaving the administrative control area into the Transuranic Storage Area or SDA must wear a personal dosimetry TLD. Based on these requirements, all personnel who enter the SDA project area will be required to wear personal dosimetry. Dosimetry for personnel entering the EZ during drilling, logging, or sampling will consist of a basic TLD and an electronic dosimeter (direct-reading dosimeter). Thermoluminescent dosimeters will be worn "face out" (beta window exposed) and have an albedo dosimeter attached to the bottom. Specific dosimetry requirements will be stated in the RWP. The Radiological Control and Information Management Systems will be used at the project work site to track external radiation exposures to project personnel. Individuals are responsible to ensure that all required personal information is provided to RadCon personnel for entry into the Radiological Control and Information Management Systems and to log in each day.

Unless otherwise directed by the RWP, personal dosimetry devices shall be worn on the front of the body between the shoulders and the waist. When circumstances are such that other parts of the body may receive significantly greater doses, the RWP may instruct personnel to wear the dosimeter in a more representative position, or may specify supplemental dosimetry.

8.3.2.5 Internal Monitoring. Internal radiation sources (removable and airborne contamination) may be encountered at probing and sampling project sites. The purpose of internal dose monitoring is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes that may occur. To indirectly measure the amount of radioactive material present inside the body, whether from naturally occurring or inadvertent uptakes, whole body counters and bioassay samples may be used. From these measurements, an internal dose may be calculated.

The estimated internal dose shall be based on bioassay data rather than air-concentration values, unless bioassay data are unavailable. If such data are not available, it will be based on representative air concentration values in accordance with 10 CFR 835.209(c). Internal dose evaluation programs shall be adequate to demonstrate compliance with Table 2-1 of 10 CFR 835(d). OU 7-13/14 integrated probing project personnel are responsible to submit all required bioassay samples upon request.

Baseline, event-based, and project-termination internal monitoring may be used to indirectly measure any deposited radioactive material in the body for field team members with the highest potential for internal uptake (e.g., samplers, driller helpers). Other field team members, who may not directly handle contaminated materials, may receive baseline and project-termination whole-body counts. All internal radiological monitoring requirements will be identified in the RWP.

8.3.3 Exposure Action levels

To prevent and mitigate potential personnel exposure to radiological, nonradiological, and physical hazards at the project site, ALs have been established for contaminants that have been evaluated and determined to present the highest exposure potential. Action levels, and associated responses, are listed on Table 8-7. If ALs are reached, personnel will take the appropriate action as stated. For upgrading PPE, the threshold (i.e., protection factor) for the particular level being worn must be exceeded, or another type of contaminant introduced, to justify PPE modification (i.e., full-face air-purifying respiratory protection offers the respiratory protection factor of 50, so the contaminant must exceed 50 times the TLV for an upgrade to be warranted).

8.4 Physical Hazards Evaluation, Control, and Monitoring

The physical hazards present at OU 7-13/14 integrated probing project sites and the methods that will be used to monitor and control them are described in this section. It is critical that all personnel are aware and understand the nature of the tasks that will be conducted, the equipment to be used, and the controls in place to eliminate or mitigate potential safety hazards.

8.4.1 Temperature Extremes

Project activities will be conducted year-round where there is a potential that both heat and cold-stress factors could affect task-site personnel, based on ambient air temperatures and layered PPE.

8.4.1.1 Heat Stress. Heat stress may result from outside temperatures during summer months and if personnel are required to wear protective clothing that prevents the body from cooling. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort, unconsciousness, to death. Personnel must inform the FTL or HSO when experiencing any signs or symptoms of heat stress or when observing a fellow employee ("buddy") experiencing them. The MCP-2704, "Controlling Exposure to Heat and Cold Stress" (INEEL 2002), and Table 8-8 of this section hrther describe heat stress hazards.

Monitoring for heat stress conditions shall be performed according to MCP-2704, (INEEL 2002). Depending on the ambient weather conditions, work conditions, type of PPE worn, and the physical response of work operations personnel, the IWRCT shall inform the FTL of necessary adjustments to the work and rest cycle. Additionally, physiological monitoring may be conducted to determine if personnel are replenishing liquids fast enough. A supply of cool drinking water will be provided in designated eating areas and consumed only in these areas. Workers may periodically be interviewed by the IH, RCT, or HSO to ensure that the controls are effective and that excessive heat exposure is not occurring.

Individuals showing any heat exhaustion symptoms listed in Table 8-8 will (1) stop work, (2) exit the work area, (3) be decontaminated (as appropriate), (4) remove protective clothing, *(5)* move to a sheltered area to rest, (6) be provided cool drinking water, and (7) be monitored by a medic, or CPR-, or first-aid-trained employee.

Personnel exhibiting signs or symptoms of heat stroke will be immediately transported to the nearest medical facility for medical attention. Section 11 details additional emergency situations and associated responses.

Table 8-8. Heat stress signs and symptoms.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating	Keep the skin clean; change all clothing daily; cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps, exhaustion, sometimes with dizziness or periods of faintness	Move the patient to a cool place nearby; give the patient half-strength electrolytic fluids; if cramps persist, or if more serious signs develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; **cold, clammy skin; heavy perspiration;** total body weakness; dizziness that sometimes leads to unconsciousness	Move the patient to a cool place nearby; keep the patient at rest; give the patient half-strength electrolytic fluids; treat for shock; seek medical attention. **DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT**
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; **dry, ~~hot skin~~;** dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching	Cool the patient rapidly. Treat for shock. If cold packs or ice bags are available, wrap them in cloth and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. **DO NOT ADMINISTER FLUIDS OF ANY KIND**

Note: Heat exhaustion and heat stroke are extremely serious conditions that can result in death and should be treated as such. Transport individual immediately to the nearest medical facility.

8.4.1.2 Low Temperatures. Exposure to low temperatures will be likely while conducting OU 7-13/14 integrated probing project activities, and also can be encountered at other times of the year if the conditions are right. Relatively cool ambient temperatures and wet or windy conditions increase the potential for cold injury to personnel. The project IH and HSO will be responsible for obtaining meteorological information to determine if additional cold stress administrative controls are required. The MCP-2704 (INEEL 2002) discusses the hazards and monitoring of cold stress. Table 8-9 provides the cold stress work and warm-up schedule. Personnel must follow Table 9-2 requirements for outer-layer protection, based on radiological and nonradiological hazards.

Working on snow and ice-covered surfaces presents additional cold weather hazards. Slipping, falling, and material-handling hazards increase under these conditions. Every effort must be made to ensure walking surfaces are kept clear of ice. The FTL or HSO should be notified immediately if slip or fall hazards are noted at OU 7-13/14 integrated probing project sites on walking and working surfaces.

Table 8-9. Cold stress work and warm-up schedule

Air Temperature °F (approximate)	No Noticeable Wind		5-mph Wind		10-mph Wind		15-mph Wind		20-mph Wind	
	Max Work Period	Number of Breaks	Max Work Period	Number of Breaks	Max Work Period	Number of Breaks	Max Work Period	Number of Breaks	Max Work Period	Number of Breaks
-15° to –19"	Normal breaks	1	Normal breaks	1	75 min	2	55 min	3	40 rnin	4
-20" to -24"	Normal breaks	1	75 min	2	55 min	3	40 min	4	30 rnin	5
-25" to -29"	75 min	2	55 min	3	40 rnin	4	30 rnin	5	Nonemergency work should cease	
-30" to -34"	55 min	3	40 rnin	4	30 rnin	5	Nonemergency work should cease			
-35" to -39"	40 rnin	4	30 rnin	5	Nonemergency work should cease					
-40" to -44"	30 rnin	5	Nonemergency work should cease							
-45° and below	Nonemergency work should cease									

8.4.2 Noise

Personnel working at the task site may be exposed to noise levels that exceed 85 decibel A-weighted (dBA) near heavy equipment or at the open panel to the drill rig motor. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear, pain, and temporary or permanent hearing loss
- Interference with communication that would warn of danger

Noise measurements (using instruments listed on Table 8-6) will be performed by the IH per MCP-2719, "Controlling and Monitoring Exposure to Noise" (INEEL 2002), to determine if personnel assigned to the jobs identified are above allowable noise exposure levels. A TLV of 85 dBA (time-weighted average) will be applied to personnel exposed to noise levels over no more than an 8-hour day. This level is based on a 16-hour recovery period in a low-noise environment. If personnel are required to work longer than 8 hours in a hazardous noise environment, then the TLV will be adjusted to a lower value in accordance with MCP-2917, (INEEL 2002). The project IH must be consulted regarding modifications to the 85 dBA 8-hour TLV value.

Personnel whose noise exposure routinely meet or exceed the allowable noise level will be enrolled in the INEEL OMP or subcontractor hearing conservation program. Personnel working on jobs that have noise exposures greater than 85 dBA will be required to wear hearing protection until noise levels have been evaluated, and will continue to wear the hearing protection specified by the IH until directed otherwise.

8.4.3 Fire, Explosion, and Reactive Materials Hazards

Fire, explosion, and reactive material hazards at the task site include combustible materials near ignition sources (hot motor or exhaust system), transfer and storage of flammable or combustible liquids in the **SZ,** and chemical reaction (e.g., reduction, oxidation, and exothermic) from incompatible waste materials. Portable fire extinguishers, with a minimum rating of 10A/60BC, shall be strategically located at the project site to combat Class ABC fires. They will be located in (1) all active work areas, (2) on or near site equipment that have exhaust heat sources, and (3) on or near all equipment capable of generating ignition or having the potential to spark. OU 7-13/14 personnel will receive fire extinguisher training as part of this HASP training, as listed on Table 4-1. Project personnel will not attempt to suppress fires that have evolved beyond the incipient stage.

8.4.3.1 Project Equipment Fire Hazards. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, diesel heaters, or other ignition sources, could result in a fire. The accumulation of combustible materials will be strictly controlled at the project site. Disposal of combustible materials shall be assessed at the end of each shift. Class A combustibles, such as trash, cardboard, rags, wood, and plastic, will be properly disposed of in metal receptacles and appropriate waste containers at the project sites. Weed control measures will be implemented (as necessary) to keep vegetation cleared around project ignition sources and structures.

Diesel fuel used at the task site to fuel the drill rig, diesel heater, and for generators will be safely stored, handled, and used. Only FM/UL-approved flammable liquid containers, labeled with the content, will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any of the facilities (trailers) and ignition sources, or stored inside an approved, flammable storage cabinet. Additional requirements are provided in Manual 14A, *Safety and Health, Occupational Safety and Fire Protection* (INEEL *2001*), and MCP-584, "Flammable and Combustible Liquids Storage and Handling" (INEEL 1997). Portable motorized equipment such as generators, diesel heaters, and so forth, will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions, before refueling, to minimize the potential for a fuel fire. Refueling tasks will only be conducted by qualified fuel-handling personnel.

8.4.3.2 Waste Reactivity and Fire Potential. The waste material in Pits 4, 6, 9, and 10 contain numerous chemical compounds and materials that, if combined or commingled in their pure form, could cause a chemical reaction that would result in the release of liberated gases, reaction intermediates, and potentially, thermal energy.

There have been long-standing safety issues associated with work activities in Pit 9 (same or similar waste forms as other SDA pits to be investigated as part of the OU 7-13/14 integrated probing project). An early indication of future issues was identified during the initial drum retrieval program, which began in July 1974 and concluded in June 1978. Based on concerns regarding the potential for explosions or fires in Pit 9 during drilling that would result in radiological releases to the aboveground environment, an independent technical review panel was formed. Experts in the areas of health physics, chemistry, explosive safety, and safety analysis reviewed the potential for such events and addressed six potential scenarios. The panel's report summary of the scenarios and resultant evaluation are provided in Figure 8-1 below.

Table ES-1. Evaluation of scenarios.

SCENARIO	DESCRIPTION	EVALUATION
1. Drilling into a mixture of nitrate salts and hydrocarbon oils.	Drums containing sodium and potassium nitrates and hydrocarbon oils and chlorinated solvents were disposed into Pit 9. The potential for the drill to encounter a mixture of nitrates and combustible organics does exist.	Explosion beyond extremely unlikely if H_2O > 5wt%. Explosion extremely unlikely if H_2O < 5wt%. Fire extremely unlikely.
2. Drilling into a mixture of nitrate salts and graphite.	Graphite (mainly in the form of chunks and large pieces) was also placed into drums and disposed into Pit 9. There is the potential for the sonic drill to encounter a mixture of nitrate salts and graphite.	Explosion beyond extremely unlikely. Fire extremely unlikely.
3. Drilling into a mixture of nitrate salts and cellulose (wood/paper).	Large quantities of wood and paperboard containers were disposed into Pit 9 permitting the possible encounter of nitrate salts and cellulose based materials.	Explosion beyond extremely unlikely if drill bit < 150°C. Fire extremely unlikely.
4. Drilling into an intact drum containing hydrogen.	Hydrogen can be produced through radiolytic decomposition of organic materials. There is the potential for the production of hydrogen and other gases.	Explosion extremely unlikely. Fire extremely unlikely.
5. Drilling into potentially pyrophoric or reactive materials, e.g., zirconium and depleted uranium; containers of picric acid, and lithium batteries.	There is documentation and, in some cases, concerns that these materials were placed in Pit 9.	Explosion extremely unlikely. Fire extremely unlikely.
6. Drilling into pressurized cylinders containing a flammable gas.	While no documentation exists which supports the disposal of pressurized gas cylinders, this possibility was considered to be credible.	Explosion extremely unlikely. Fire extremely unlikely.

Figure 8-1. Independent technical review panel report evaluation of potential scenarios.

Any surface fire that may occur will be fought only in the incipient state (small fire extinguishable) with hand-held extinguishers. If a surface fire cannot be extinguished safely with a hand-held extinguisher, the area will be placed in a safe shut down mode and the project site evacuated, in accordance with procedures provided in Section 11.

8.4.3.3 Preliminary Results of Cold Test Sonic Drilling for Simulated Pit 9 Wastes.

Preliminary results of cold test sonic drilling for the OU 7-10 (i.e., Pit 9) are also applicable to the OU 7-13/14 integrated probing project SDA locations. A sonic drilling test was conducted at the RSI (sonic drill rig vender) facility in Woodland, California from July 6 to July 9, 1998,. to demonstrate the safety of sonic drilling methods in representative Pit 9 waste and worst case waste scenarios. Accordingly, two waste cylinders were prepared with unique waste to determine the following data objectives:

1. Determine if a noncoated drill bit will spark if it were to encounter a solid carbon steel object while advancing with rotation through Pit 9

2. Measure the temperature in simulated waste containers and the substrate, while advancing the sonic drill bit through this waste using a series of thermocouplings

3. Verify that no exothermic reaction occurs during core drilling through nitrate salt, oil, and organic mixture.

The sonic drill rig was used to core through the waste contained in the test cylinders with the following results:

1. No sparks were observed or measured when the noncoated drill bit was advanced using a combination of sonic and rotational (up to 60 rpm) methods into a 3/4-in. piece of carbon steel.

2. The maximum temperature increase measured in the waste (i.e., two 1-in. thick polyethylene sheets and concrete) and substrate (soil) was 63°F.

3. The nitrate and oil, and nitrate and wood chips mixtures showed no trace of heat affect for the sonic drilling. Additionally, the nitrate mixtures were subject to direct flame from a propane torch and did not burn, even after prolonged exposure. The organic material burned as long as it was in direct contact with the flame, but did not sustain burning when the flame was removed.

Based on results from these cold tests under worst case conditions, the probability of a reaction from probing through the Pit 9 waste material is considered minimal. A complete review of the California cold test is described in the *OU 7-10 Staged Interim Action Stage I California Combustion Test Report* (Shenvood 1999).

Additional safety analyses and heat calculations have been performed to calculate operating parameters taking into account drilling variables, such as advancement rate, oscillation frequency, and rotation. Restrictions primarily apply to the installation of Type A probes because they have a much larger surface area and require significant power output to penetrate the overburden and waste layers. These restrictions are identified in the Type-A and -B technical procedures. These restrictions are in place to ensure that the probe tip temperature does not exceed 150°C.

8.4.4 Biological Hazards

The OU 7-13/14 integrated probing project locations are in areas that provide habitat for various rodents, insects, and reptiles. Based on biological studies done at the INEEL, deer mice have been known to carry the hantavirus. The virus is present in the nesting and fecal matter of deer mice. The potential exists for project personnel to disturb nesting or fecal matter during the course of mobilization and intrusive activities. If such materials are disturbed, they can become airborne and create a potential inhalation pathway for the virus. Also, contact and improper removal of these materials may provide additional inhalation exposure risks.

If rodent nesting or excrement material is encountered, the IH or HSO will be notified immediately and no attempt shall be made to remove or clean the area. Following an evaluation of the area, an SWP will be written for disinfecting and removing the material from the project task area in accordance with MCP-2750, "Preventing Hantavirus Infection" (INEEL 2002). The IH will provide the necessary guidance for protective equipment, mixing, and application of the disinfecting solution (bleach solution) and proper disposal method for the waste.

Snakes, insects, and spiders may be encountered at the project site. Common areas to avoid include material stacking/staging areas, under existing structures (e.g., trailers and buildings), under boxes, and other areas that provide shelter for snakes. Protective clothing will prevent insects from direct contact with personnel; however, repellant (DEET or equivalent) may be required during Level D activities. Areas where standing water has accumulated provide breeding grounds for mosquitoes and should be avoided. In cases where large areas of standing water are encountered, it may be necessary to pump the areas dry or add a small concentration of nonhazardous surfactant to the water to break the surface tension (mosquito hatching phases). Consult with the project and RWMC environmental coordinator before adding surfactant to standing water areas

8.4.5 Confined Spaces

Work in confined spaces may subject personnel to risks involving engulfment, entrapment, oxygen deficiency, and toxic or explosive atmospheres. No confined spaces are present at OU 7-13/14 integrated probing project task sites.

If a confined space is identified and not properly posted, it will be treated as a permit-required confined space until a determination is made by an assigned safety/IH professional. Entrances shall be posted with the required danger or caution sign, per MCP-2749, "Confined Spaces" (INEEL 2002). A confined space entry permit is required before an employee can enter a confined space, in accordance with MCP-2749.

8.4.6 Safety Hazards

Industrial safety hazards pose a significant, if not the most likely threat to personnel while performing OU 7-13/14 integrated probing project tasks. Section 6 provides general safe-work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to be followed to eliminate or minimize potential hazards to project personnel.

8.4.6.1 Handling Heavy Objects. During probing and drilling operations, handling and maneuvering of probes, drilling cases, bits, glove bags, and various other pieces of equipment may result in employee injury. Manual material handling will be minimized through task design and use of mechanical and hydraulic lifts whenever possible.

If probeholes must be abandoned, personnel may be required to handle bags of Bentonite or sand to perform mixing operations. Bags can weigh over 36 kg (80 lb) and present a serious back strain hazard. Personnel shall not lift objects over 50 lb without mechanical assistance or the help of another person, and will be trained in the proper methods in accordance with PRD-5121 (INEEL 2002). In addition, the FTL or HSO periodically will review the basics of safe lifting during POD safety briefings.

8.4.6.2 Powered Equipment and Tools. All power equipment and tools will be properly maintained and used by qualified individuals according to the manufacturer's specifications. The PRD-5101, "Portable Equipment and Handheld Power Tools" (INEEL 2001) will be followed for all work performed with powered equipment. All power tools and equipment used outdoors will be ground fault circuit interrupter protected.

8.4.6.3 Heavy Equipment and Moving Machinery. The hazards associated with the operation of heavy equipment include injury to personnel, equipment damage, and property damage. All heavy equipment will be operated in the manner in which it was intended and according to manufacturer's instructions. Only authorized personnel will be allowed in the vicinity of operating heavy equipment and should maintain visual communication with the operator. Work-site personnel shall comply with PRD-5123, "Motor Vehicle Safety" (INEEL 2002) and MCP-2745, "Heavy Industrial Vehicles"(INEEL 2001).

Task-site personnel working around or near the drill rig, logging truck, and other moving machinery shall comply with the appropriate MCPs and DOE-STD-1090-99, "Hoisting and Egging" (1999). Additional safe practices will include:

- All heavy equipment will have backup alarms.

- No one may walk directly in back of or to the side of heavy equipment without the operator's knowledge. All precautions must be taken before moving heavy equipment.

- While operating heavy equipment in the work area, the equipment operator shall maintain communication with a designated person responsible for providing direct voice contact or approved standard hand signals. In addition, all site personnel in the immediate work area shall be made aware of the equipment operations.

- All equipment shall be kept out of traffic lanes and access ways. Equipment shall be stored safely, so no personnel will be endangered at any time.

- All project personnel will maintain a safe distance from any of the rotational drilling components while operating.

8.4.6.4 Hoisting and Rigging of Equipment. Moving some drill rig support materials (e.g., hydraulic line) may require hoisting and rigging for loading and unloading from trailers. All hoisting and rigging of the sonic drill rig will be performed in accordance with PRD-160, "Hoisting and Rigging" (INEEL 2000), and DOE-STD-1090-99 (1997), as applicable for OU 7-13/14 operations. Hoisting and rigging equipment will have a current inspection tag and be inspected by qualified personnel before use. Additionally, for mobile cranes or boom trucks, the operator or designated person shall visually inspect equipment for the following each day or before use if the crane has not been in regular service:

- All control mechanisms for maladjustment that would interfere with proper operation

- Crane hooks and latches for deformation, cracks, and wear

- Hydraulic systems for proper oil level

- Lines, tanks, valves, pumps, and other parts of air or hydraulic systems for leakage

- Hoist ropes for kinking, crushing, birdcaging, and corrosion

- All anti-two-block, two-block warning, and two-block damage prevention systems for proper operation.

Note: The operator or other designated person shall examine deficiencies and determine whether they constitute a safety hazard. If deficiencies are found, they shall be reported to the SP.

8.4.6.5 Electrical Hazards and Energized Systems. Electrical equipment and tools as well as underground/surface electrical lines may pose shock or electrocution hazards. Safety-related work practices shall be employed to prevent electrical shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the requirements in PRD-5099, "Electrical Safety" (INEEL 2002), MCP-3650 (INEEL 2001), MCP-3651 (INEEL 2001), RWMC supplemental MCPs, and Parts I through III of NFPA 70E, "Electrical Safety Requirements for Employee Work Places" (2000). In addition, all electrical work will be reviewed and completed under the appropriate work controls (i.e., SWP, JSA, or work order).

Before beginning any subsurface penetrations, personnel will (1) contact the RWMC outage coordinator to obtain underground utility clearance, (2) obtain subsurface investigation clearance, in

accordance with MCP-151, "Subsurface Investigations," and (3) meet the 48-hour advanced notice requirement for any surface penetration.

8.4.6.6 Working and Walking Surfaces. OU 7-13/14 integrated probing project tasks will be performed year-round. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, slips, and falls. The SDA presents inherent tripping hazards because of uneven terrain, existing surface penetrations (i.e., probes), and conduit. Additionally, the potential for slip, trip, and fall hazards will increase during winter months because of ice- and snow-covered surfaces, combined with objects beneath the snow. All personnel will be made aware of existing tripping hazards in proximity of the drill rig and sampling locations during the prejob briefing.

8.4.6.7 Personal Protective Equipment. Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. Also, PPE can increase the risk of heat stress. Work activities at the task site will be modified, as necessary, to ensure that personnel are able to work safely in the required PPE. Work-site personnel shall comply with PRD-5121 (INEEL 2002), and MCP-432, "Radiological Personal Protective Equipment" (INEEL 2000). Project PPE levels for each task are described in Section 9 and listed in Table 9-1.

8.4.6.8 Decontamination. Decontamination procedures for personnel and equipment are detailed in Section 10. Because of the unique nature of contamination (TRU mixed waste), the Section 10 procedures will serve as the primary decontamination method for all personnel and equipment if contamination is encountered at the OU 7-13/14 integrated probing project sites. The appropriate INEEL MCPs provide additional requirements for chemical and radiological decontamination requirements.

Decontamination procedures (Section 10) and applicable MCPs must be followed and the appropriate level of PPE worn during decontamination activities. Project RadCon and IH personnel will follow MCP-148, "Personnel Decontamination" (INEEL 2000) and Manual 14B *Safety and Health-Occupational Health* (INEEL 2003), MCPs, and general IH practices.

Note: If decontamination of equipment is required, the appropriate location for decontamination will be evaluated by the HSO, in consultation with RWMC RadCon personnel, based on the nature of the contamination, extent of decontamination required, and a new RWP will be written.

8.4.7 Inclement Weather Conditions

The inclement or adverse weather conditions that may pose a threat to persons or property at the task site (for example, sustained strong winds 25 mph or greater) electrical storms, heavy precipitation, or extreme heat or cold) will be evaluated by the FTL with input from the HSO, IH, SP, RCT, and other personnel, as appropriate. Stop work and mitigation measures will be determined and communicated to field personnel. During all activities, OU 7-13/14 integrated probing project RadCon and IH personnel will determine if wind or other weather conditions pose unacceptable hazards to personnel or the environment.

8.4.8 Cryogenics

Logging tool detectors require cooling with liquid nitrogen (LN2). Liquid nitrogen will be supplied to the logging tool using standard gas fittings and a feed line for each tool. A LN2 storage cylinder (approximately 160 L) will be filled, as required, by an INEEL commercial compressed gas vender under existing RWMC work controls. The logging subcontractor will make LN2 tool feed-line connections to this storage cylinder. All LN2 tasks will be conducted and protective equipment worn in accordance with MCP-2736, "Cryogenic Systems" (INEEL 1997) and as listed on the applicable JSA.

8.4.9 Compressed Gas Cylinders

Compressed gas cylinders containing P_{10} gas (carrier gas for scalers and PCM) and argon gas (used during lysimeter water sample collection) will be used at OU 7-13/14 integrated probing project sites. All cylinders will be stored and handled in accordance with PRD-5040, "Handling and Use of Compressed Gases" (INEEL 2002). Additionally, the SP should be consulted regarding any compressed gas cylinder storage or handling issues.

8.5 Other Task-Site Hazards

Task-site personnel continually should look for potential hazards and immediately inform the FTL or HSO of hazards so that action can be taken to correct the condition. The HSO, RCT, and FTL will be at the project site and visually inspect the site to ensure that barriers and signs are being maintained, unsafe conditions are corrected, and debris is not accumulating on the site. Periodic safety inspections will be performed by the SP or HSO in accordance with MCP-3449 (INEEL 2001), using an OU 7-13/14-specific checklist. Additionally, targeted and required self- assessments may be performed during operations in accordance with MCP-8 (INEEL 2002). . All inspections and assessments will be noted in the FTL logbook or on the appropriate checklist to be filed in the project folder.

Health and safety professionals present at the task site may, at any time, recommend changes in work habits to the FTL or HSO. However, all changes that may affect the OU 7-13/14 project written work control documents (HASP, JSAs, RWPs, and SWPs) must have concurrence from the appropriate project technical discipline representative on site and a document action request prepared, as required.

9. PERSONAL PROTECTIVE EQUIPMENT

The OU 7-13/14 integrated probing project poses potential hazards to personnel who conduct drilling, logging, sampling, and support activities. These hazards include the SDA buried waste material (TRU mixed waste), industrial safety hazards, and chemicals used at project sites (e.g., nitric acid, fuel). Engineering controls, proceduralized operations, specialized training, and administrative controls will eliminate or mitigate many hazards, but personnel must augment these controls with PPE to hrther reduce the potential hazards. The purpose of PPE is to shield or isolate personnel from chemical, radiological, physical, or biological hazards that cannot be eliminated though engineering or other controls and may be encountered at the project site. It is important to realize that no PPE ensemble can protect against all hazards under all conditions and that work practices and adequate training will also provide a greater level of protection to workers.

Selection of the proper PPE to protect OU 7-13/14 integrated probing project personnel is based on the following:

- Project tasks to be conducted (e.g., mobilization, drilling/probing, logging, Type-B probe sampling)
- Physical hazards at project sites (e.g., equipment, tools, energy sources)
- Known or suspected radiological and nonradiological materials and agents expected to be found at SDA task sites
- Potential contaminant routes of entry
- Physical form and chemical characteristics of contaminants
- Acute and chronic affects from exposure to contaminants
- Local and systemic toxicity of contaminants
- Anticipated exposure levels
- Hazard analysis (Section **8)** evaluation of this HASP.

Personal protective equipment is generally divided into two broad categories: (1) respiratory protective equipment, and (2) personal protective clothing. Both of these categories are incorporated into the four, standard levels of protection (Levels A, B, C, and D). Table 9-1 provides guidance in the selection process for respiratory and protective clothing. Site-specific hazards and contaminants will continually be evaluated when determining the most appropriate PPE level and modifications. Based on the known and anticipated hazards at OU 7-13/14 integrated probing project sites and exposure monitoring conducted, Level D or modified Level D will serve as the primary PPE level.

Anti-contamination (anti-C) requirements are dictated by RWP, in conformance with MCP-432 (INEEL 2000).

Table 9-1. Respiratory and protective clothing selection.

Respiratory Personal Protective Equipment Selection[a]	
Hazard	**Level of Protection**
Not immediately dangerous to life or health (IDLH) or oxygen-deficient atmospheric conditions. Gaseous, vapor, particulate or aerosol chemicals or radionuclides.	Level C—full facepiece Level B—full facepiece supplied air respirator or airhood HEPA and chemical combination cartridge or airhood for concentrations up to the protection factor of an air-purifying full-facepiece respirator and within the assigned DAC" value
IDLH or oxygen deficient-atmospheric conditions. Gaseous, vapor, particulate or aerosol chemicals or radionuclides.	Level B—full facepiece, supplied air respirator with an escape-only SCBA" or Level A—SCBA HEPA and chemical combination cartridge for concentrations up to the protection factor of an air-purifying full-facepiece respirator and within the assigned DAC" value

a. A multichemical and HEPA combination cartridge to be selected by IH and RadCon personnel based on specific task hazards.

Protective Clothing Selection	
Low-atmospheric contaminant levels that are present under stable conditions. No anticipated immersion, splashes, or potential for unexpected contact with chemical or radiological contaminants.	Level D (primary level of PPE for OU 7-13/14 tasks)
Moderate-atmospheric contaminants under relatively stable conditions, liquid splashes, or other direct contacts that do not have corrosive characteristics or can be absorbed by exposed skin. Low radiological contamination and airborne radioactivity levels.[c]	Level C (upgrade contingency only)
Moderate-to-high atmospheric contaminants under unstable conditions, potential for contact with wet, contaminated surfaces and material that can saturate or permeate Level C protective clothing. Moderate radiological contamination and airborne radioactivity levels.[c]	Level B (not anticipated to be used)
High- and unknown-atmospheric contaminants, potential for contact with substances that pose a high hazard potential to the skin, high potential for splash, immersion or exposure to unexpected vapors, gases, aerosols, or dusts that may present an IDLH situation and is readily absorbed through the skin. High radiological contamination and airborne radioactivity levels.[c]	Level A (will not be required)

a. Derived air concentration, based on specific radionuclides.
b. SCBA = self-contained breathmg apparatus.
c. Contamination levels and airborne radioactivity as defined by 10 CFR 835.603.d.

HEPA = high efficiency particulate air
PPE = personal protective equipment

9.1 Respiratory Protection

Several of the radiological and nonradiological contaminants of the buried waste present a significant potential respiratory hazard if released in an airborne respirable form. Table 8-4 and Section 8 of this HASP presented (1) the contaminants and exposure potential based on the tasks to be completed, (2) amount and form of hazardous constituents, and (3) engineering controls that will be implemented. The only time buried waste constituents will be brought to the surface is during Type-B probe sampling. Water and vapor samples will be collected from an instrumented Type-B probe after it has passed through the porous, stainless steel segment of the probes. Samples will be collected inside a glove bag that serves as a barrier to prevent personnel from direct contact with potential waste contaminants. Therefore, using respiratory protection is anticipated as a contingency only.

The level and type of respiratory protection are task-specific and relate directly to the airborne hazards for each given task or activity. Task-based respiratory protection and protective clothing required are listed on Table 9-2. Required levels of respiratory protection will vary based on specific tasks. Personnel will not exceed the assigned protection factors of the respiratory devices listed on Table 9-3.

All personnel required to wear tight fitting respirators shall complete training and be fit-tested before being assigned a respirator, per the training and documentation requirements in Section 4 of this HASP. Requirements for respirator use, emergency use, storage, cleaning, and maintenance, as stated in the MCP-2726, "Respiratory Protection" (INEEL 2003) shall be followed.

9.2 Personal Protective Equipment Levels

This subsection provides detail and explanation of the two levels of PPE anticipated for use during OU 7-13/14 integrated probing project tasks (i.e., Level D and C [with Level C being a contingency only]). Modifications to these levels shall be made under the direction of the HSO in consultation with the project IH and RadCon personnel, as appropriate. Such modifications are routinely employed during HAZWOPER site activities to maximize efficiency and to meet site-specific needs without compromising personnel safety and health. Because of the TRU mixed waste contamination that will be encountered at the project site, special attention will be given to both respiratory and protective clothing modifications to meet specific task requirements. The HSO, IH, and RadCon will determine what modifications are appropriate to the PPE levels listed on Table 9-2.

9.2.1 Level D Personal Protective Equipment

Level D PPE will only be selected as a work uniform and not on a site with respiratory or skin absorption hazards requiring whole body protection. Level D PPE provides no protection against airborne chemical hazards, but rather is used for protection against nuisance contamination and physical hazards. Level D PPE will only be allowed in areas that have been characterized or are known to have never been contaminated. At the OU 7-13/14 integrated probing project site, Level D PPE or modified Level D, will serve as the primary level of PPE during all tasks. The basic Level D PPE ensemble may be modified to provide protection from skin and physical hazards, but not respiratory protection.

Basic Level D PPE consists of the following:

- Standard work clothes or coveralls (as determined by the IH or RCT)
- Hard hat (as required by safety engineer and type of work being performed)
- Eye protection (safety glasses with side shields as a minimum, (see PRD-5121 (INEEL 20021)
- Safety footwear (steel or protective toe and shank, as determined by the safety engineer).

Table 9-2. OU 7-13/14 integrated probing project task-based personal protective equipment requirements and modifications.

Task or Assignment	Level of Personal Protective Equipment	Modifications and Comments
• Mobilization and site preparation, • Probehole installation (Type A and B)	**Level D** (primary)	All tasks will be conducted in Level D personal protective equipment (PPE) with some modification for hand and head protection, as warranted.
• Downhole logging • Type-B probe sampling • Support activities (surface mapping, surveying, soil gas sample collections) • Cold Test Pit activities • Overburden Screening • Tomography	Modified Level D (contingency only)	Upgrade to modified Level D (protective clothing) for sampling or probehole installation tasks, if surface contamination is detected above radiological work permit limits and no airborne contamination or other tasks require modified Level D PPE.
	Level C (contingency only)	If atmospheric contaminants increase to concentrations above designated action limit, Level C air-purifying respiratory protection (chemical or radiological) will be worn in conjunction with chemical protective clothing (Tyvek coveralls or equivalent).

Note: Personnel must inspect all PPE before donning and entry into any work zone. Items found to be defective, or that become unserviceable during use, will be doffed and disposed of in accordance with posted procedures and placed into the appropriate waste stream. Personal protective equipment inspection guidance is provided in Section 9.4 of this HASP.

Table 9-3. Assigned respiratory protection factors."

	Respiratory Inlet Covering (Full Facepiece)	
Type of Respirator	Chemical Assigned Protection Factor	Radiological Assigned Protection Factor
Air-purifying	100	50[b,c]

a. "*Respiratory Protection,* ANSI Z88.2-1980.

b. Particulates only. When HEPA filters are used in atmospheres not containing radioactive gas.

c. MCP-432, "Radiological Personal Protective Equipment" (INEEL 2000).

Optional Level D modifications consist of the following:

- Chemical or radiological protective clothing (e.g., Tyvek, Saranex) as prescribed in task-specific RWP or SWP
- Chemically resistant hand and foot protection (e.g., inner/outer gloves, boot liners)
- Radiological modesty garments under outer protective clothing
- Any specialized protective equipment (e.g., hearing protection, cryogenic gloves, face shields, welding goggles, aprons).

9.2.2 Level C Personal Protective Equipment

Level C PPE shall be worn when the task site chemical or radiological contaminants have been well characterized, indicating that (1) personnel are protected from airborne exposures by wearing air-purifying respirators with the appropriate cartridges, (2) no oxygen-deficient environments exist (<19.5% at sea level), and (3) there are no conditions posing immediate danger to life or health.

Basic Level C PPE shall include Level D ensemble with the following respiratory and whole-body protection upgrades:

- Full-facepiece air-purifying respirators equipped with a NIOSH-approved HEPA and chemical combination cartridge (IH to specify chemical combination cartridge)
- Chemical-resistant coveralls (e.g., Tyvek QC, Tychem 7500, or Saranex-23-P) as prescribed in task-specific RWP or SWP (IH to specify material)
- Chemical-resistant outer shoe or boot cover (IH or RCT to specify material)
- Inner chemical-resistant nitrile rubber gloves with cotton liners (as determined by the IH or RCT)
- Outer chemical-resistant Viton or polyvinyl alcohol gloves (as determined by the IH)

Optional Level C modifications consist of the following:

- Radiological modesty garments under outer protective clothing
- Any specialized protective equipment (e.g., hearing protection, welding lens, aprons)

9.2.3 Level B and Level A Personal Protective Equipment

Level B PPE is not anticipated to be required for any OU 7-13/14 integrated probing project tasks, based on the nature of the project tasks, engineering controls, and hold points in the procedures. If Level B respiratory protection or skin protection requirements are identified, the specific tasks shall be halted and the HSO in consultation with the FTL, RadCon, IH, SP shall meet with the OU 7-13/14 PM and determine if work should continue at the location or whether it should be abandoned. Level B PPE will only be used after exposure levels have been documented and procedures, JSAs, and RWPs amended to include additional hold points and limiting conditions. Level A PPE will not be worn for this project.

9.3 Protective Clothing Upgrading and Downgrading

The OU 7-13/14 integrated probing project HSO, in consultation with the project IH and RadCon personnel, will be responsible to determine when to upgrade or downgrade PPE requirements. Upgrading or downgrading PPE requirements based on current conditions is a normal occurrence. Action levels, listed on Table 8-7 in Section 8, provide the basis for determining such decisions.

The following are reasons to upgrade or downgrade PPE:

- Upgrading criteria (work will stop immediately if PPE upgrading is required)
  - Unstable or unpredictable site radiological or nonradiological hazards
  - Contaminants that are difficult to monitor or detect
  - Known or suspected presence of skin absorption hazards
  - Temporary loss or failure of any engineering controls
  - Identified source or potential source of respiratory hazards
  - Change in the task procedure that may result in increased contact with contaminants or increased difficulty in meeting any of the criteria listed above.
- Downgrading criteria
  - New monitoring data information that shows the contaminant levels to be lower than established action limits
  - Implementation of new engineering or administrative controls that eliminate or significantly mitigate hazards
  - Elimination of potential skin absorption or contact hazards
  - Change in site conditions that results in the removal of physical hazards or reduces or isolates them to a controlled area
  - Completion or change in tasks that results in the elimination of key hazards that require higher levels of PPE.

9.4 Inspection of Personal Protective Equipment

All PPE ensemble components must be inspected before use and when in use within the OU 7-13/14 project work zones. Self-inspection and the use of the buddy system, once PPE is donned, will serve as the principal forms of inspection. If at any time PPE should become damaged or degradation/permeation is suspected, an individual will inform others of the problem and proceed directly to the work zone exit point to doff and replace the unserviceable equipment. Table 9-4 provides an inspection checklist for common PPE items.

Table 9-4. Personal protective equipment inspection checklist.

Personal Protective Equipment Item	Inspection
Gloves	Before use: Pressurize gloves to check for pinholes: blow in the glove, roll until air is trapped, and inspect. No air should escape. For leather gloves, inspect for deterioration, damage, or excessive soiling.
Respirators (full-facepiece)	Before use: Check condition of the facepiece, head straps, valves, connecting lines, fittings, and all connections for tightness. Check cartridge to ensure proper type and combination for atmospheric hazards to be encountered, inspect threads and O-rings for pliability, deterioration, and distortion.
Modified Level D and C clothing	Before use: Visually inspect for imperfect seams, nonuniform coatings, tears, and other problems. Hold PPE up to the light and inspect for pinholes, deterioration, stiffness, and cracks. While wearing in the work zone: Look for evidence of chemical attack, such as discoloration, swelling, softening, and material degradation. Inspect for tears, punctures, and zipper or seam damage. Check all taped areas to ensure they are still intact.

10. DECONTAMINATION PROCEDURES

Decontamination of equipment, materials, and sample containers is anticipated to be minimal (or not required at all) based on contaminant sampling and surveys conducted during probehole installation tasks in Pits 4, 9, and 10. Sample containers used for the collection of Type-B water or vapor samples inside the glove bag would have the highest chance for encountering contamination. Every effort will be made to prevent contamination of personnel and equipment through the use of engineering controls, isolation of source materials, continuous site monitoring and surveying, personnel training, and by following all contaminated-material-handling requirements and procedures. This section provides contingencies for decontamination if contamination is encountered.

10.1 Contamination Control and Prevention

Contamination control and prevention procedures will be implemented throughout this project to minimize personnel contact with contaminated surfaces. At OU 7-13/14 integrated probing project sites in the SDA, the following contamination control and prevention measures will be employed:

- Identify potential sources of contamination by conducting frequent surveys and collecting swipes.
- Design confinement, isolation, and engineering controls to eliminate or mitigate any potential for contact or release of known sources of contamination
- If contamination is found on inner surfaces of the glove bag confinement, immediate decontamination procedures will be implemented to prevent the spread of contamination (see Subsection 10.2.2 of this HASP)
- Use geomembrane around the drilling point in the SDA to provide a better surface to conduct required radiological surveying and swiping, reduce contaminant migration, and hasten decontamination, if contamination is noted on the geocomposite surface
- Use remote drill operational controls to reduce the number of personnel in the immediate area (within 15 m [50 ft]) during drill string advancement
- Wear disposable outer garments and use disposable equipment (where required).

Note: Any radiological contamination detected above those levels listed in the "Limiting Conditions That Void the RWP" Section of the RWP will immediately result in a **stop work action** and void the RWP. Any decontamination required will be performed under a separate RWP.

10.2 Personnel and Equipment Decontamination

Decontamination procedures for personnel and equipment would be necessary to control contamination and protect personnel if it is encountered. Both chemical and radiological contamination will be decontaminated from surfaces. Because of the nature of the contamination source material at OU 7-13/14 integrated probing project sites (TRU mixed waste), and limitations of direct-reading organic-vapor instrumentation, radiological contamination will serve as the best proxy for detecting both radiological and nonradiological surface contamination. Industrial hygiene instrumentation also will be used to detect off-gassing of VOCs from surface contamination, along with other qualitative methods (e.g., pH paper, as appropriate).

All radiological decontamination operations for equipment and areas shall be performed in accordance with Chapter 4 of Manual 15A (INEEL 2000). Nonradiological decontamination will be evaluated on a case-by-case basis by the HSO and project IH to determine the most appropriate PPE (Level C protective clothing will initially be selected until site monitoring can demonstrate downgrading is warranted). Nonradiological contamination is not expected to be present without some detectable radiological contaminants, given the nature of the waste materials disposed in the SDA over the years. Specific personnel and equipment decontamination methods are provided below.

10.2.1 Personnel Decontamination

Engineering controls, in conjunction with project contamination prevention and control practices, and proper protective clothing donning and doffing procedures, will serve as the primary means to eliminate the need for personnel decontamination. Procedures for donning and doffing protective clothing (if required to be worn) will be posted at all established radiological contamination area entrances and exits. All PPE items will be inspected before being donned. Table 9-4 in Section 9 describes how to inspect PPE items. After donning protective clothing, your buddy (or the HSO or RCT) will check to verify proper donning technique.

Gross contamination of surfaces also increases the probability of personal contact and cross-contamination. If cross-contamination is found on glove bag surfaces, it will be immediately decontaminated to prevent transfer to sample containers and gloves.

If contamination is encountered and decontamination of equipment is required, then anti-C PPE will be worn to conduct these tasks. Careful removal of PPE will be the primary decontamination method at OU 7-13/14 integrated probing project sites, if protective clothing is contaminated. Section 10.3 of this HASP provides additional information of PPE doffing sequence and decontamination techniques.

Removal of contaminated PPE, using standard radiological doffing techniques (rolling outer surfaces inward while being removed), provides the most effective method to contain and isolate the contaminants and greatly reduces the potential for exposure to other personnel who would be put at risk of cross-contamination from other decontamination methods (e.g., washing, brushing). Contamination on the upper areas of the protective clothing poses a greater risk to workers because volatile or radiological substances may become airborne closer to the breathing zone and create an inhalation hazard for both the individual and others in the immediate vicinity. Any excessive motion (ripping off tape, snapping gloves or booties) will greatly increase the chance of generating airborne contamination. A wipe-down with maslins may be required before doffing anti-Cs. This will be based on surveys and work activities in conjunction with onsite RadCon support personnel.

10.2.2 Decontamination in Medical Emergencies

An injured or ill person will immediately be evaluated by first-aid trained personnel at the OU 7-13/14 integrated probing project task site (on a voluntary basis). If the person's condition is serious, then the FTL will contact the RWMC SS or Warning Communications Center (WCC) to summon emergency services (i.e., Fire Department, CFA medical).

Medical care for serious injury or illness will not be delayed for decontamination. In such cases, gross contamination may be prevented by removing the injured person's outer protective clothing (if possible) and covering other contaminated areas, for example, with a bag or glove. If contaminated PPE cannot be removed without causing hrther injury (except for the respirator which must be removed), the individual will be wrapped in plastic, blankets, or available material to help prevent contaminating the inside of the ambulance, medical equipment, and medical personnel. The IH or RCT (depending on the

type of contamination) shall accompany the employee to the medical facility to provide information and decontamination assistance to medical personnel. Contaminated PPE will then be removed at the CFA medical facility and carehlly handled to prevent the spread of contamination. Manual 15A ,Chapter 5 (INEEL 2000) and MCP-148 (INEEL 2000) contains information on proper handling of radiologically contaminated wounds.

Based on the TRU mixed waste at SDA pits, chemical contamination only is unlikely. However, the same decontamination procedure for injured personnel with radiological contamination will be followed for chemically contaminated personnel. This includes removing the outer layer of protective clothing and evaluating the individual for other surface contamination. If the remaining contamination appears to be corrosive, the affected area will be wiped with a dampened Teriwipe saturated with the premixed amended water solution (described in Section 10.2.1of this HASP). This solution will bind particulate radiological contamination and chemically buffer acidic or basic substances. This process may need to be repeated. The affected areas will then be covered during transport to the medical facility.

10.2.3 Equipment Decontamination

The sampling glove bag confinement has been designed as an engineering control to isolate contamination, if encountered, and to prevent migrating outside the glove bag. Project IH and RadCon personnel will conduct surveys and collect swipes throughout project tasks, in accordance with the technical procedures to evaluate engineering controls, material handling methods, and confinement integrity.

Both real-time instrumentation and visual observation will be used to detect contamination within and beyond the immediate project area. Equipment and personnel decontamination will use both instrumentation and visual methods for contamination detection and to minimize the potential spread and airborne generation of contamination. Where radiological and IH concerns do not prohibit their use, TPR-51[a]and TPR-52[b] will be followed. If contamination is encountered, RadCon and IH personnel will evaluate any contaminated equipment to determine the most appropriate decontamination method based on the (1) nature of the contaminated item, (2) degree of contamination, (3) level of effort to decontaminate the item, and (4) importance in decontaminating versus disposing of such items. In some cases, the level of effort and potential to spread contamination from conducting decontamination tasks far outweigh the benefit from engaging in extensive decontamination efforts to return an item to service. A cost-ALARA versus benefit evaluation will be done on items that have extensive contamination or are relatively inexpensive. Low-cost, consumable items will be discarded if initial decontamination efforts fail, or extensive decontamination is required that is not in accordance with ALARA principles.

A decontamination pad may be established in the CRC for decontamination of previously (radiological) free-released equipment. If it is deemed necessary and appropriate by OU 7-13/14 integrated probing project IH, then a wet wiping with the aforementioned amended water solution or potentially steam cleaning of this equipment before leaving the CRC may be conducted.

10.3 Doffing Personal Protective Equipment and Decontamination

As stated earlier, no personnel decontamination beyond doffing of PPE is anticipated for this project. If contamination is detected on outer PPE layers, careful removal of these outer PPE layers will generally eliminate over 99% of contamination and this will serve as the primary decontamination method if

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a. TPR –5 1, "Decontamination of Heavy Equipment in the Field" (Draft).

b. TPR-52, "Decontamination of Sampling Equipment in the Field' (Draft)

protective clothing is contaminated. Removal of contaminated protective clothing using standard radiological doffing techniques (rolling outer surfaces inward while being removed) provides the most effective method for containing and isolating the contaminants and greatly reduces the potential for exposure to other personnel who would be put at risk of cross-contamination from other decontamination methods (e.g., washing, brushing).

Some preliminary surface decontamination of protective clothing may be required if they are grossly contaminated and the potential for the generation of airborne radioactivity or organic vapor emissions exists. This will involve assistance from other personnel inside the contamination area and at the doffing station, as described below. The ultimate goal of all decontamination methods is to effectively and efficiently isolate the source of contamination through removal of protective clothing and containment in a sealed bag or waste container.

Removal of respiratory protective devices will be the most critical element of the doffing procedure to prevent potential uptake through inhalation of contaminants. This is a demonstrated skill that has been performed as part of passing the DOE Core Radiological Worker II practical exam qualification.

Since any personnel contamination event would likely involve a TRU-mixed-waste residue, decontamination of personnel shall follow the general procedures of the Manual 15A, Chapter 5 (INEEL 2000), and MCP-148 (INEEL 2000) with some modifications for nonradiological constituents based on recommendations from the project IH. The primary difference in standard radiological and chemical decontamination is the use of water or other decontamination solutions with the chemical decontamination. Because of the TRU (alpha) components of the waste residue, the use of such solutions will be kept to a minimum. All decontamination tasks will be conducted under the direct supervision of INEEL RadCon REs or RCTs and INEEL IH personnel.

Dry, capture-type decontamination methods will be used whenever possible to decontaminate small areas of surface contamination. These include using a HEPA vacuum, adhesive tape, or similar technique. Contaminated surfaces will then be resurveyed to confirm the contamination was removed. The next progressive approach for removal of surface contamination will include the use of a spray bottle filled with amended water (amended with nonphosphate detergent and sodium bicarbonate) to make an aqueous solution used to mist the contaminated surface, followed by a wiping with a Teriwipe towel (or equivalent). Decontamination methods may be altered by the RCT or IH. Confirmation surveys will be conducted following these decontamination techniques. Personnel and personal property decontamination procedures that may be used include taping, vacuuming (vacuum equipped with a HEPA filter), spray and wipe techniques, or other approved techniques. One of the primary objectives will be to avoid creating any free liquids. All waste generated from decontamination will be handled, stored, and managed in accordance with Section 10.4 of this HASP.

The specific doffing sequence of modified Level-D or -C PPE, and any required decontamination, will be based on the nature of the contamination and specific OU 7-13/14 project site configuration. A general approach for doffing modified Level-D or -C PPE is described below. However, there is no one doffing strategy that works for all circumstances and modifications to this approach are appropriate if site conditions change or at the discretion of the project HSO in consultation with the project IH and RWMC RadCon personnel. Both radiological and non-radiological (chemical) hazards will be evaluated.

10.3.1 Modified Level-D Personal Protective Equipment Doffing and Decontamination

Personnel may be required to wear modified Level-D protective clothing for some OU 7-13/14 project tasks. Doffing sequence and technique will follow standard radiological removal techniques and will constitute the initial decontamination step. If the protective clothing is also being worn as an anti-C

layer, then tape, gloves, booties, and any required dosimetry will be removed following the posted sequence. All PPE will be placed in the appropriately labeled waste disposal container(s). Doffing and any required decontamination will take place at the designated work area boundary or in a contamination RBA step-off pad (if a radiological contamination area is established). If exiting a radiological contamination area, personnel will conduct the proper personal survey, as stated in the RWP (if written).

10.3.2 Level-C Personal Protective Equipment Doffing and Decontamination (if required)

If respiratory protection is worn in conjunction with protective clothing (Level-C PPE), the modified Level-D sequence will be followed with one additional step. Following protective clothing doffing, respirators will be removed and placed in a separate container. Doffing and any required decontamination will take place at the designated work area boundary or in a contamination RBA step-off pad if a radiological contamination area is established. If exiting a radiological contamination area, personnel will conduct the proper personal survey as stated in the RWP.

10.3.3 Personnel Radiological Contamination Monitoring

A whole body radiological contamination survey may be required immediately following the doffing procedure listed above. RadCon control personnel may perform this survey or a self-survey may be required. The RadCon personnel will determine the specific model and type of monitoring instruments, based on the type and level of contamination. The following are guidelines for conducting a personal contamination survey using hand-held instruments.

Survey instructions will be posted and include the following:

- Verify that the instrument is in service, set to the proper scale, and the audio output can be heard during frisking
- Hold probe less than ½ in. from surface being surveyed for beta and gamma contamination, and approximately ¼ in. for alpha contamination (without touching surface)
- Move probe slowly over surface, approximately 2 in. per second for beta-gamma probe and 1 in per second for alpha probe
- If the count increases during frisking, pause 5 to 10 seconds over the area to provide adequate time for instrument response
- If the count rate increases to a value greater than **100 cpm above background with a beta-gamma instrument or** ***any*** **detectable contamination with an alpha detection instrument,** remain in TA-2 and notify (or have someone notify) RadCon personnel
- Whole-body survey should take approximately 2 to ***3*** minutes to complete; remember to frisk hands before picking up probe, and perform the survey in order posted.
- Following personal contamination survey, immediately proceed to the PCM station located inside the RadCon trailer or WMF-601 for an automated whole-body survey.

10.4 Disposal of Contaminated Personal Protective Equipment and Equipment

10.4.1 Storage and Disposal of Contaminated Materials

Sampling activities will likely be the source for investigation-derived waste (IDW) generated from the OU 7-13/14 integrated probing project. Sources of IDW may include:

- Used PPE (e.g., protective clothing, gloves, booties, respirators)
- Small tools and equipment that cannot or will not be decontaminated or released
- Radiologically controlled area materials (e.g., step-off pads, bags, swipes, plastic, sheeting)
- Decontamination waste (e.g., wipes, bags).

Equipment that cannot be decontaminated will be bagged, labeled, and containerized in accordance with: 10 CFR 835.601(a) (radiological), RCRA and CERCLA requirements, and the *DOE Radiological Control Manual,* Chapter 4, and placed in an appropriately posted radiological or CERCLA storage area at the OU 7-13/14 subsurface contamination project site (area of contamination). All IDW generated from sampling in the decontamination process (if required) must be handled and disposed of in accordance with requirements from (1) MCPs, (2) Chapter 4 of Manual 15A (INEEL 2000) (3) receiving-facility waste acceptance criteria (offsite), and (4) *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* (DOE-ID 2000a).

10.4.2 Site Sanitation and Waste Minimization

OU 7-13/14 integrated probing project personnel will use toilet facilities located inside the RWMC. Potable water and soap will also be available at the site for personnel to wash their hands and face in the RWMC operations area (WMF-657).

Note: It is important to note that any required radiological contamination surveys must be performed **before** washing face and hands to prevent accidental spread of contamination.

Waste materials will not be allowed to accumulate at the task site. Appropriate containers for contaminated and noncontaminated waste will be maintained at appropriate locations at the task site. The RCT will survey waste before it is removed from the task site in accordance with standard SDA practices. Personnel should make every attempt to minimize waste through judicious use of consumable materials. All task-site personnel are expected to make good housekeeping a priority at the job site.

11. EMERGENCY RESPONSE PLAN

Activities during the OU 7-13/14 integrated probing project will be conducted in a manner that ensures the highest degree of protection for site personnel, the general public, and the environment. This section defines the responsibilities of project and emergency personnel and provides actions for responding to various events that may occur during the OU 7-13/14 integrated probing project.

This section has been written to comply with the emergency response plan requirements of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," subpart 1910.120(l). This emergency response plan addresses both OU 7-13/14 project emergency response and nonemergency response events as defined by 29 CFR 1910.120(a)(3). The intent of this plan is to provide OU 7-13/14 project personnel with event planning and response actions before initiating project activities.

Note: The HAZWOPER term "emergency" is not defined the same as an "emergency" as classified by DOE Orders 151.1, Change 2, "Comprehensive Emergency Management System" and 232.1, "Occurrence Reporting and Processing of Operations Information." For this reason, the term "event" will be used in this section when referring to OU 7-13/14 project HAZWOPER emergencies.

All "events" will be reported to RWMC ERO personnel through the RWMC **SS** for classification in accordance with Section 4 of the *INEEL Emergency Plan/RCRA Contingency Plan,* PLN-114 (INEEL 2002b).

The PLN-114 implements DOE Orders 151.1 and 232.1 and describes the process developed to respond to and mitigate consequences of emergencies that might arise at the INEEL. Each INEEL facility has a specific addendum that supplies facility-specific information to PLN-114. The RWMC facility is Addendum 3. All RWMC and OU 7-13/14 project initiated emergencies will result in activation of the RWMC ERO, as specified in Addendum 3. Once the ERO is activated, OU 7-13/14 project personnel will follow the direction and guidance communicated by the RWMC Emergency Coordinator (EC).

For OU 7-13/14 project initiated events, the OU 7-13/14 project FTL will serve as the on-scene commander and single point of contact until relieved by an RWMC/INEEL ERO member or until the OU 7-13/14 integrated probing project site is evacuated. The OU 7-13/14 project personnel will take immediate response actions, in a graded approach, as described in Subsections 11.1.1, 11.1.2, and 11.1.3 of this HASP, if an OU 7-13/14 project event occurs. These actions will be taken to (1) ensure the safety of project personnel, (2) control or mitigate event consequences through safe shutdown of equipment (where feasible), and (3) minimize the potential impact to offsite (beyond OU 7-13/14 project site) personnel. The FTL or designee will provide technical support to the RWMC command post during emergency events for the project.

11.1 Pre-Event Planning and Drills

The objective of pre-event planning is to be prepared to safely respond to anticipated events and contingencies before commencement of OU 7-13/14 project activities. Preplanning is also used to ensure that the OU 7-13/14 integrated probing project emergency response plan is integrated with the existing PLN-114 and RWMC Addendum 3, and that the INEEL emergency response organization is familiar with the nature of the project. Planning will prepare the following:

- Identify the location of and route to emergency medical services (CFA-1612)

- Establish that site communications are working properly (i.e., radios, cell phones, and landlines [if available])

- Designate OU 7-13/14 project site emergency warning signals (onsite emergencies) and evacuation routes (for onsite and RWMC/INEEL evacuations)

- Inventory emergency equipment and supplies (Table 11-1 of this HASP)

- Provide a tour to ERO representatives of the OU 7-13/14 project site and provide all information requested

- Communicate OU 7-13/14 project event and INEEL emergency procedures to all project personnel and visitors, as part of the site-specific training.

In addition, a local OU 7-13/14 project emergency drill has been conducted to ensure all personnel are familiar with the emergency actions, communications, and evacuation routes. Additional drill information is discussed in Subsection 11.1.5 of this HASP.

This emergency response plan divides events into the following three primary categories: (1) OU 7-13/14 integrated probing project site events that require notifying the RWMC SS, but not a response from INEEL emergency response personnel (e.g., fire department), (2) OU 7-13/14 project site events that require the response of INEEL emergency response personnel or the evacuation of all OU 7-13/14 project personnel because of an onsite, RWMC, or other INEEL facility alarm, and (3) events that will require immediate evacuation from the OU 7-13/14 project site.

11.1.1 OU 7-13/14 Integrated Probing Project Site Events (Notification Only)

These types of events will require some level of response by all OU 7-13/14 project site personnel In all cases, a formal notification will be made to the RWMC SS for classification of the event. Also, notifications to INEEL/subcontractor project and department personnel, RWMC facility, and ER representatives, and other appropriate parties (e.g., environmental affairs and the occupational medical program) as listed in Subsection 11.9 of this HASP may be required. Examples of these types of events include, but are not limited to, the following:

- Minor personal injury on the task site requiring medical evaluation or treatment (but not ambulatory)

- Personnel contamination or suspected uptake of radiological or hazardous substance

- Equipment or vehicle accident that results in damage to the vehicle or property

- Unexpectedly high radiation dose to personnel (greater than the ALARA goal) from logging source or other source

Note: Personnel will follow MCP-190, "Event Investigation and Occurrence Reporting g" (INEEL 2000) to determine the proper reporting following any OU 7-13/14 project events.

11.1.2 OU 7-13/14 Integrated Probing Project Site Events (INEEL Emergency Response Organization Required)

These types of events will present different response options for OU 7-13/14 project personnel, depending on the nature and severity of the event. Ambulance, fire, rescue, and hazardous materials response services are available from the INEEL fire department/medical facility. Project personnel will generally perform one of the following:

- Use emergency stops on all equipment (where available), evacuate the immediate task area (EZ), remain at the OU 7-13/14 project site (upwind and at a safe distance), and make immediate notification to the RWMC **SS,** who is responsible to alert the INEEL emergency service organizations (INEEL fire department). The RWMC **SS** will account for all personnel and report to the RWMC EC.

Note: If it is not determined that using available equipment emergency stops will expose personnel to unacceptable hazards, then everyone will immediately evacuate the task area and shutdown will consist of all power being shut down from the drill rig control panel structure.

- Following evacuation of the immediate task area, personnel will proceed out of the SDA to the nearest assembly area (if conditions at the task site change, become worse, or if directed by the RWMC EC). Personnel will proceed upwind along the predetermined route (determined based on a primary and secondary route) to an established assembly area, depending on the prevailing winds and nature of the evacuation. At the assembly area, the RWMC **SS** will account for all personnel and report to the RWMC EC.

A positive sweep of the OU 7-10 project site and trailers will be done by the HSO and FTL before evacuating the site. The personnel will proceed upwind along the predetermined route (determined based on a primary and secondary route) to an established assembly area (windgap, south construction, Pit 9 east or west gate), depending on the prevailing winds and nature of the evacuation (see Figure 11-1). Accountability of field team members and non-field team personnel will be conducted by the FTL using the OU 7-13/14 project site sign-in sheet and the buddy system.

The FTL notifications will include pertinent details regarding the nature of the emergency (e.g., radiological, medical, fire, spill), number of personnel affected, and exact location of the incident The FTL will make additional notifications listed in Subsection 11.9 of this HASP, as appropriate.

Examples of these types of OU 7-13/14 project events include, but are not limited to, the following:

- Fire that is burning beyond an incipient stage and cannot be extinguished with hand-held extinguishers

- A spill at the project site that cannot be immediately contained or controlled

- Small episodic airborne release beyond the radiologically controlled area resulting from damage to the glove bag, or other confinement (from fire or failure)

- Serious injury to a worker or workers.

Note: Personnel will follow MCP-190, "Event Investigation and Occurrence Reporting" (INEEL 2000) to determine the proper reporting following any OU 7-13/14 project events.

Note: If the OU 7-13/14 project site is evacuated because of an OU 7-13/14 project event, then recovery and reentry procedures must be followed, as directed by the RWMC/INEEL ERO in accordance with Section 9 of PLN-114 and its associated implementing procedures.

11.1.3 OU 7-13/14 Integrated Probing Project Site Evacuation

An evacuation order could be the result of an OU 7-13/14 project site, RWMC-, or INEEL-initiated event or emergency. Regardless of the source, all personnel will place the project site in a safe shutdown mode (as appropriate) and evacuate the project site and SDA **IMMEDIATELY,** using the predetermined route to an established assembly area, depending on the prevailing winds and nature of the evacuation. At the assembly area, the RWMC **SS** will account for personnel and report to the RWMC EC.

If an evacuation is initiated by an OU 7-13/14 project event, then the FTL will make immediate notification to the RWMC **SS** and appropriate personnel listed in Subsection 11.9 of this HASP. An RWMC-initiated or Site-wide evacuation will require all OU 7-13/14 project personnel to evacuate through the appropriate SDA gate, as specified on the speaker system or 6-Net radios. The FTL will account for all personnel before exiting the assembly area, using the daily OU 7-13/14 project site sign-in sheet and the buddy system.

If off-site notifications are required (outside the RWMC or INEEL), they will be made by the RWMC Command Post personnel, as stated in Section 5 of PLN-114. The INEEL ERO will classify these types of events using Section 4 of PLN-114. Examples of these types of events or emergencies include, but are not limited to, the following:

- Uncontrollable fire at the OU 7-13/14 project site, RWMC, or other facility upwind of the OU 7-13/14 project site
- RWMC or other facility operational emergency
- Catastrophic event that results in a significant or prolonged airborne radioactivity or hazardous material release at the OU 7-13/14 project site
- Natural disasters (e.g., earthquakes, wild fire, lightning, tornadoes)
- Any event meeting the criteria of an emergency as defined by DOE Order 151.1.

Note: Personnel will follow MCP-190, "Event Investigation and Occurrence Reporting" (INEEL 2000) to determine the proper reporting following any OU 7-13/14 project events.

Note: If the OU 7-13/14 project site is evacuated because of an OU 7-13/14 project event, recovery and reentry procedures must be followed as directed by the INEEL ERO in accordance with Section 9 of PLN-114, and its associated implementing procedures.

11.1.4 Spills

The only potential for a liquid spill would be from equipment reheling tasks at the OU 7-13/14 project site. If the spills are small enough to be safely contained at the task site, task-site personnel will handle spill control using spill supplies at the site and immediately report the incident to the RWMC **SS.** The RWMC EC will determine reporting requirements, in accordance with MCP-190, "Event Investigation and Occurrence Reporting" (INEEL 2000). Radiological releases (contamination) in

uncontrolled areas are considered spills. If any release of a hazardous material (nonradiological) occurs, task site personnel shall comply with the following immediate spill response actions:

Untrained initial responder (or if the material characteristics are unknown):

- Use emergency stops to shutdown equipment (as appropriate)
- **Evacuate** and **isolate** the immediate area
- Notify and then seek **help** from and **warn** others in the area
- **Notify** FTL or HSO.

Trained responder, material characteristics are known, no additional PPE is required:

- Seek **help** from and **warn** others in the area
- **Stop** the spill, if it can be done without risk (e.g., return the container to upright position, close valve, shut off power)
- **Provide** pertinent information to FTL and HSO
- Place all equipment in a secure shutdown mode
- **Secure** any release paths only in an emergency. Otherwise, make a plan, fill out paperwork, and respond. Don appropriate PPE and conduct RCT/IH surveys of the area to determine the extent of spill.

Additional requirements, information, and response equipment for specialized spills (e.g., oil, polychlorinated biphenyls) is provided in the RWMC Addendum 3, Appendix G, "Spill Plan Control and Countermeasures" (SPCC).

11.1.5 Emergency Drills

The OU 7-13/14 integrated probing project has conducted a local emergency drill (coordinated with the RWMC ERO and INEEL Emergency Preparedness Department) to evaluate field-team-member response during a project event. The purpose of this drill was to familiarize personnel with their respective event and emergency response actions. All radio or telephone communications that are used during drills shall be immediately preceded and followed with a statement that clearly identifies the situation as a drill to prevent an actual emergency response from being initiated by the WCC. Additional drills may be conducted at the discretion of the FTL, OU 7-13/14 project PM, or the INEEL Emergency Preparedness Department.

Each drill or actual event at the task site will be followed by a critique and any identified deficiencies in the emergency plan will be corrected. Critiques are described hrther in Subsection 11.8 of this HASP.

11.2 Emergency Recognition and Prevention

All OU 7-13/14 project personnel should be constantly alert for potential hazardous situations and signs and symptoms of chemical and radiological exposure or releases. All OU 7-13/14 project personnel

will be trained in proper site access and egress in response to OU 7-13/14 project events and INEEL emergencies as part of the OU 7-13/14 project HASP project-specific training. Visitors will also receive this training on a graded approach, based on their access requirement. Training will cover alarm identification, location and use of communication equipment, location and use of site emergency equipment, and evacuation routes. Emergency phone numbers and evacuation route maps will be located in the SZ (OU 7-13/14 project trailer), and in the EZ or CRZ (inside the drill-rig control trailer). All field personnel should be familiar with the techniques for hazard recognition and assigned ALs. Section 11.4 of this HASP describes specific roles and responsibilities, once an event is initiated.

Personnel will hold a POD meeting daily before entering the EZ, to discuss the following:

- Tasks to be performed (e.g., location, equipment, personnel)
- Radiological and chemical hazards that may be encountered, including their effects, how to recognize symptoms, monitoring to be conducted, and other physical hazards
- Event and evacuation procedures to be followed after an alert signal (OU 7-13/14 project internal communication), or an RWMC or site alarm is sounded (including primary and secondary evacuation routes).

As integrated probing activities progress, new equipment and more intrusive activities will require additional items to be discussed during daily POD briefings. Constant air monitors may be placed at strategic locations within the EZ to provide alarms in the event of a radiological, airborne release. Constant air monitors will be calibrated and maintained in accordance with MCP-93, (INEEL 1999).

11.3 Emergency Facilities and Equipment

Emergency response equipment that will be maintained at the OU 7-13/14 project task site is listed in Table 11-1, along with the persons responsible to inventory and maintain this equipment. Addendum 3 (RWMC) to PLN-114 lists emergency equipment available at the RWMC. This includes the command post (CP) located in building WMF-637, and equipment located in building WMF-601 (e.g., self-contained breathing apparatus), CBAs, dosimeters, air samplers, decontamination, first-aid equipment). In addition, Section 11 of PLN-114 lists all INEEL emergency facilities and equipment available. The INEEL fire department maintains an emergency hazardous material van that can be used to respond to an event or emergency at the OU 7-13/14 project site. Fire department personnel are also trained to provide immediate hazardous material spills and medical services. At least two persons with current medic/first-aid training will be present at the OU 7-13/14 project site to render first-aid assistance to injured personnel. Project RadCon and IH personnel will assist with all emergency decontamination efforts.

The INEEL fire department has a mutual-aid agreement with the Idaho Falls, Blackfoot, and Arco fire departments to supplement the equipment and resources of the INEEL.

As IDW is stored at the OU 7-13/14 project site in a temporary accumulation area, Appendix L of RWMC Addendum 3 to PLN-114 will be amended to include specific spill and response equipment located at or in the temporary accumulation area.

Table 11-1. Emergency response equipment for the OU 7-13/14 integrated probing project.

Equipment Name and Quantity Required	Location at Task Site	Responsible Person	Frequency of Inspection or verification"
First-aid kit	SZ or CRZ	HSO	Monthly–check seal only
Eyewash bottles[b]	EZ or CRZ	HSO	Monthly
Eyewash station			
Hazardous materials spill kit	CRZ or SZ	HSO	Verification
Radiological spill kit	CRZ, SZ or WMF-601	RCT	Verification
Extra PPE	WMF-657, CRZ or SZ	HSO	Verification
Communication equipment (operational)	On site	FTL	Daily radio check
Fog horn (1) for signaling onsite alerts	CRZ or EZ	HSO	Verification
Fire extinguishers‘	EZ	HSO	Monthly
Other: Wind sock (1)	EZ, CRZ or SZ	FTL	Verification

a. Verification that equipment is present at the designated project location; no inspection tag is required.

b. An eyewash bottle will be used to provide an immediate eye flush, if required. An eye wash station is available withm the SDA area that meets the ANSI Z 358.1-1990 requirements. This location will be identified by the IH during the pre-job briefing.

c. A minimum of one 10A/60BC extinguisher. If used, return for servicing and recharging.

CRZ = contamination reduction corridor EZ = exclusion zone FTL = field team leader
HSO = health and safetv officer SZ = support zone

11.4 Personnel Roles, Lines of Authority, and Communication

This section provides information on the roles and responsibilities of all OU 7-13/14 project personnel during project-site events and INEEL emergency conditions. Additionally, both internal and external communication methods are detailed along with notification responsibilities during events and emergencies. OU 7-13/14 project personnel will take immediate action to control or mitigate events at the project site (as appropriate); however, once the RWMC or INEEL ERO is activated, it will serve as the primary response organization during all emergencies. Table 11-2 lists the responsibilities of the FTL, HSO, and medic and first-aid personnel during an OU 7-13/14 project event.

The INEEL ERO is structured to fit the diversity of the INEEL and to optimize its resources. It is an umbrella structure that consists of three basic levels: (1) on-scene, based at the on-scene CP, (2) the RWMC CP (for OU 7-13/14 project emergencies), and (3) INEEL or DOE-ID management, based at the Emergency Operations Center.

During INEEL emergencies, the Incident Command System (ICS) is used. The ICS is an emergency management system designed for use from the time an incident occurs (even at less-than-emergency category events) until the requirements for emergency management and operations no longer exist.

Table 11-2. Responsibilities during an OU 7-13/14 project event or RWMC/INEEL emergency.

Responsible Person	Action Assigned
FTL or designee	Contact RWMC SS or WCC and signal evacuation
FTL or designee	Conduct accountability and report to RWMC SS
FTL or trained designee	Serve as area warden
HSO, medic, and first-aid trained personnel	Provide first-aid to victims (voluntary basis only)
FTL or designee	Report spill to RWMC SS[a]
FTL or designee	Support the RWMC command post as technical representative

a. The RWMC SS or emergency coordinator Will contain the environmental affairs spill response categorization/notification team

FTL=field team leader
HSO=health and safety officer
RWMC=Radioactive Waste Management Complex
SS=shift supervisor
WCC=Warning Communications Center

The structure of the ICS can be established and expanded or contracted depending on the changing conditions of the event. The system consists of procedures to control personnel, facilities, equipment, and communications. The intent is to staff and operate the ICS with trained, qualified, personnel from the responding INEEL ERO. In the event an incident requires a unified command with multiple agencies, the ICS adapts quickly to facilitate that effort, including incidents involving multiple jurisdictions.

11.4.1 Project Personnel

Every person at the OU 7-13/14 project site has a role to play during an event or INEEL emergency. The FTL will account for all personnel using the OU 7-13/14 project sign-in sheet and the buddy system. The FTL or trained designee will serve as the area warden for the OU 7-13/14 project, and report personnel accountability to the RWMC SS, following an evacuation. Additionally, all project personnel are responsible to immediately report any event at the OU 7-13/14 project site to the FTL or HSO.

11.4.2 Field Team Leader

The OU 7-13/14 project FTL will serve as the OU 7-13/14 project on-scene commander during all project events until relieved by an RWMC/INEEL ERO member. When relieved, the FTL will support emergency operations at the project site or at the RWMC CP (as requested). The FTL is responsible to initiate all requests for emergency services (e.g., fire and medical) by notifying the RWMC SS. An additional responsibility includes personnel accountability if a project or INEEL site evacuation is required. All project personnel will follow the directions given by the FTL (or RWMC EC if the ERO is activated) during project events and INEEL emergencies. Following an evacuation, the FTL will ensure all project personnel are accounted for and make appropriate notifications to the RWMC SS, OU 7-13/14 project management, and others listed in Subsection 11.9.

11.4.3 Radioactive Waste Management Complex Emergency Coordinator

The RWMC EC, or designated alternate (meeting the same training requirements), is capable and familiar with all aspects of the RWMC Addendum 3 to PLN-114, all operations and activities at the facility, the characteristics of the OU 7-13/14 project waste, the location of all records within the facility, and the layout of the RWMC and OU 7-13/14 project site. The CFA emergency action manager will provide direct support logistics and limited operations support to the RWMC EC.

The RWMC EC assumes primary responsibility to respond to and coordinate all emergency situations at the RWMC, including the SDA. The RWMC EC takes appropriate measures to ensure the safety of RWMC personnel and the public. Possible actions may involve evacuation of personnel from the OU 7-13/14 project site, the SDA, the entire RWMC, or areas within the emergency-planning zone. Additionally, the RWMC EC is responsible to implement emergency procedures, coordinate protective actions and corrective measures, and perform offsite notifications, as required. All field team members may be called upon to assist the EC to take emergency actions or provide information of on-site conditions and radiological and hazardous materials present.

11.4.4 Emergency Communications

It is critical that both internal and external communication systems be established for use during an OU 7-13/14 project event or emergency. Failure to immediately warn onsite personnel of event situations could result in potential physical harm or exposure to radiological or nonradiological OU 7-13/14 project hazards. During an event or response, crucial information must be conveyed quickly and accurately to onsite project personnel and the RWMC ERO. Information communicated regarding the OU 7-13/14 project (e.g., location of injured personnel; orders to evacuate the site; notices of blocked evacuation routes) must be understood by all project personnel during times of confusion and while wearing PPE.

A set of internal emergency signals has been developed and will be rehearsed during OU 7-13/14 project emergency drills. Additionally, clear external communication (cell phones or radios) must be established to request RWMC and INEEL ERO emergency services (as required). External communication systems and procedures will be available and accessible to all site personnel.

11.4.4.1 Internal Communications. An internal communications system is used to alert OU 7-13/14 project personnel to danger, convey safety information, and maintain site control. Radios or local radio headsets will be used to communicate response messages to site personnel. Additionally, Table 11-3 lists a set of backup signals (i.e., audible horn blasts).

11.4.4.2 External Communications. External communication systems will be used at the OU 7-13/14 project site to alert RWMC SS of event conditions at the project site and to receive incoming information regarding RWMC or other INEEL-initiated emergencies. CM-net, 6-Net radios and cellular phones will serve as the primary method by which the RWMC shift supervisor and INEEL ERO resources are contacted.

All project personnel must be familiar with the type and location of external communication devices and the proper protocol to summon assistance. The FTL will serve as the primary contact to notify the RWMC Shift supervisor; however, all project personnel must be able to perform this duty.

Table 11-3. OU 7-13/14 project internal emergency signals.

Device or Communication Method	Signal and Associated Response
Fog or vehicle horns (blasts)	**One long** blast — Emergency evacuation, evacuate project site immediately. Proceed in an upwind direction to designated assembly area as specified by FTL or RCT for radiological event. **Two short** blasts — Non-emergency evacuation of immediate work area. Proceed to designated assembly area as specified by FTL or RCT (radiological event). **Three long** blasts or verbally communicated — All clear, return to project site.

11.4.5 Notifications

The notification process will be used to summon INEEL emergency response resources, alert RWMC ERO of OU 7-13/14 project events, and to inform project management of project incidents as soon as possible. An event at the OU 7-13/14 project site will require the FTL to notify the RWMC **SS** and may require INEEL emergency response resources (e.g., fire, medical). Hand-held radios, cellular phones, and landline phones (if available) can all be used to contact RWMC **SS** or INEEL emergency response personnel (if the RWMC **SS** cannot be reached).

When notifying RWMC **SS,** ERO, INEEL emergency response, or WCC personnel, all available information on the incident should be provided, to include the following:

- Informant's name, phone number, pager number
- Exact location of the event or emergency (in relation to the OU 7-13/14 project site or other landmarks)
- Nature of the event or emergency and special hazards (e.g., fire, medical, radiological)
- Time of occurrence and current site conditions
- Injuries or fatalities (i.e., numbers injured, type of injuries, status of injured, if they will require decontamination)
- Extent of damage to area and any mitigating actions taken
- Any additional information requested

Following notification of the RWMC EC, the event will be classified in accordance with DOE Orders 151.1, Change 2, "Comprehensive Emergency Management System" and 232.1, "Occurrence Reporting and Processing of Operations Information" as outlined in Section 4 PLN-114 (INEEL 2002).

11.5 Idaho National Engineering and Environmental Laboratory Alarms and Responses

Alarms and signals are used at the RWMC and INEEL to notify personnel of emergency conditions that require a specific response. Regardless of the classification, once an event is categorized as an emergency, the RWMC EC immediately notifies RWMC personnel of appropriate protective actions by activating the voice paging system and/or alarm system. Siren-generated signals serve as the primary means to notify RWMC personnel, OU 7-13/14 personnel, and visitors in the area, to take protective actions. The INEEL alarm systems consist of the necessary equipment to actuate alarm sirens, either manually or automatically. The alarms produce two types of signals: **steady (take cover)** or **alternating (evacuate).** A fast-ringing bell usually denotes radiation-monitoring alarms. Fire alarms are often distinctive for each facility and may vary from building to building within the RWMC.

The two primary INEEL site emergency alarms may be activated during the course of the OU 7-13/14 activities. These include "TAKE COVER' and "EVACUATION" alarms. These will be used to alert OU 7-13/14 personnel of RWMC or Site-wide emergency situations. The RWMC regularly conducts testing of its alarm system. The time and frequency of these tests will be determined and communicated to project personnel by the FTL during the daily POD meeting.

11.5.1 Take Cover–Continuous Siren

Radiation or hazardous material releases, weather conditions, or other event or emergency conditions may require that all personnel take cover indoors in the nearest building (i.e., OU 7-13/14 RadCon trailer, WMF-657, or other RWMC building). A take-cover/shelter signal may be initiated as part of a broader response to an emergency situation and may precede an evacuation order. It may also be given by word of mouth, radio, or emergency notification system before sounding. The signal to take cover/shelter is a CONTINUOUS SIREN that can be heard throughout the RWMC area. OU 7-13/14 personnel will proceed to the nearest trailer, building, or shelter and await hrther instructions. Eating, drinking, or smoking is not permitted during take cover conditions.

O U7-13/14 RadCon, IH, and HSO personnel will assist and direct all workers in the radiological controlled area during a take cover/shelter alarm. If an evacuation alarm is sounded during doffing procedures, follow the evacuation procedures described below.

Personnel working in radiologically controlled areas will perform the following:

- Use emergency stops to shut down equipment
- Immediately proceed to the controlled exit point and follow posted doffing procedures
- Monitor as directed by RadCon personnel in the RBA
- Exit the EZ to the project trailer in the SZ.

11.5.2 Total Area Evacuation–Alternating Siren

A total area evacuation is the complete withdrawal of personnel from an area. If the EC or emergency action manager initiates a total area evacuation, follow directions given by the RWMC EC as to which SDA evacuation route to use. OU 7-13/14 personnel will proceed along the directed evacuation route to the designated assembly area.

Personnel working in radiological areas will perform the following:

- Use emergency stops to shut down equipment (as appropriate)
- Immediately evacuate the area (do not remove protective clothing)
- Proceed along the directed evacuation route to the designated assembly area
- If abnormal radiological situations are present, personnel will adhere to MCP-124, "Response to Abnormal Radiological Situations" (INEEL 2002).

Note: Because of the potential for cross-contamination of other areas and personnel, it is important for individuals still wearing potentially contaminated clothing to stand downwind away from others in the assembly area and avoid unnecessary movement. Radiation control personnel will direct doffing and decontamination procedures as soon as possible.

11.6 Evacuation Routes and Procedures

Evacuation routes have been established for the SDA and OU 7-13/14 project site based on the layout of the work zones, prevailing winds, availability of egress routes, and SDA gate locations. Routes will be directed from the EZ through the upwind CRZ to the SZ (when possible), and from the SZ to a selected RWMC assembly area (should conditions require a RWMC or SDA evacuation). Primary and secondary evacuation routes will be maintained by the RWMC. Evacuation route maps will be located in the SZ and the CRZ or EZ (inside the drill-rig control trailer).

Figures 11-1 and 11-2 show the evacuation routes from the OU 7-13/14 project site and assembly area pickup locations, respectively. Figure 11-3 shows the route to the CFA medical facility (CFA-1612).

11.7 Reentry and Recovery

11.7.1 Reentry

The reentry procedure following an evacuation of the OU 7-13/14 project site will be determined by the source and nature of the evacuation (OU 7-13/14-initiated or RWMC or another facility). Reentry into an originating area will be carefully planned and controlled to minimize exposing personnel and equipment to radiation, hazardous materials, unstable physical conditions, or other hazards. Both reentry and recovery are carefully planned and controlled to prevent initiating another event or emergency. The recovery team will develop a recovery plan that includes a plan for reentry. The primary consideration for reentry is a rescue or corrective action.

Reentry activities may include the following:

- Perform safe shutdown duties assigned by the RWMC EC (if not conducted before evacuating)
- Perform operations that may mitigate the effect of the hazardous condition (e.g., cover or shield exposed radiation sources, extinguish hot spots, and seal openings)
- Search for unaccounted-for personnel or ascertain that all personnel who were in the affected area have been evacuated (if not accounted for in the assembly area)

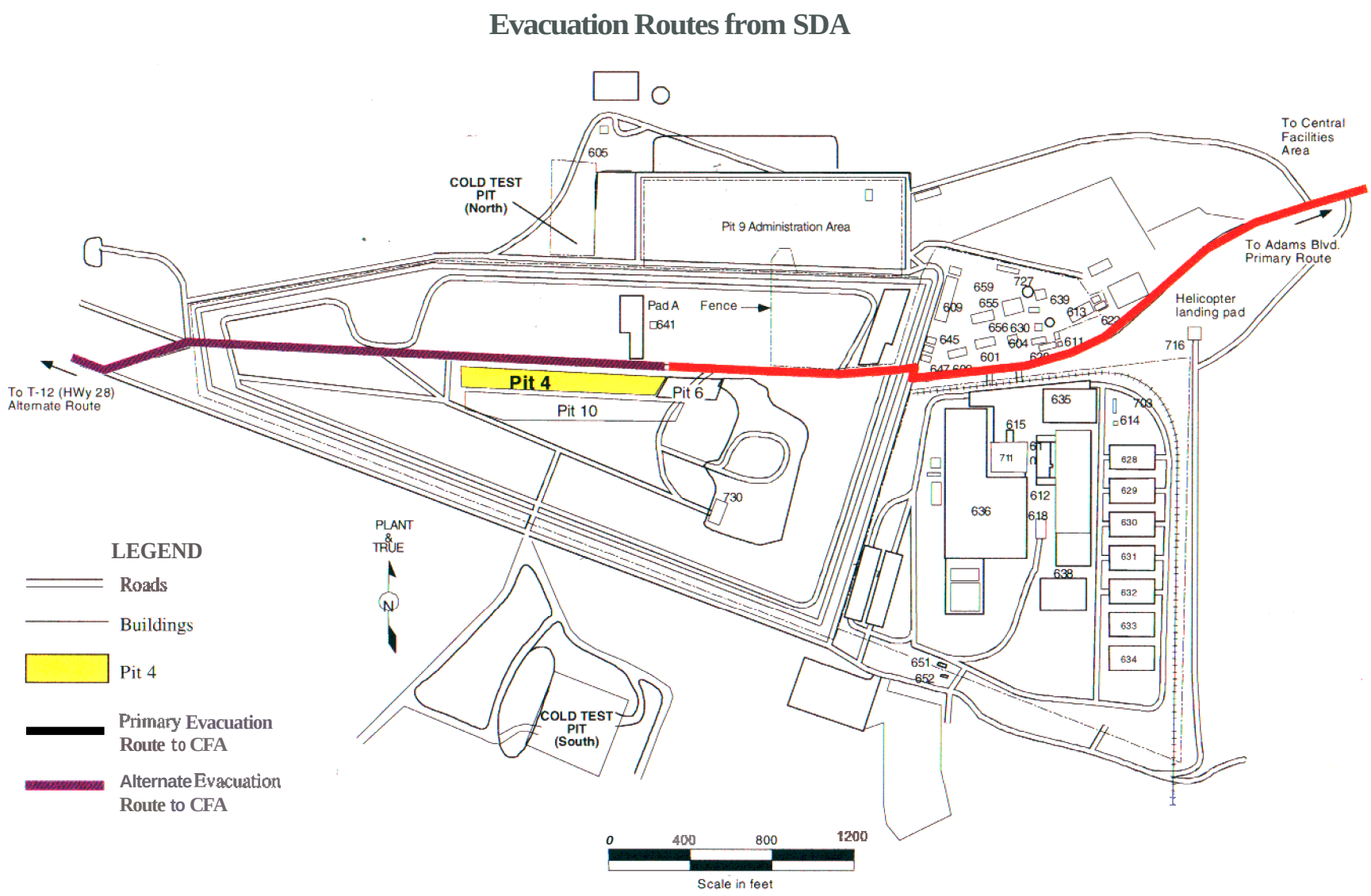

Figure 11-1. Evacuation routes for Radioactive Waste Management Complex Subsurface Disposal Area.

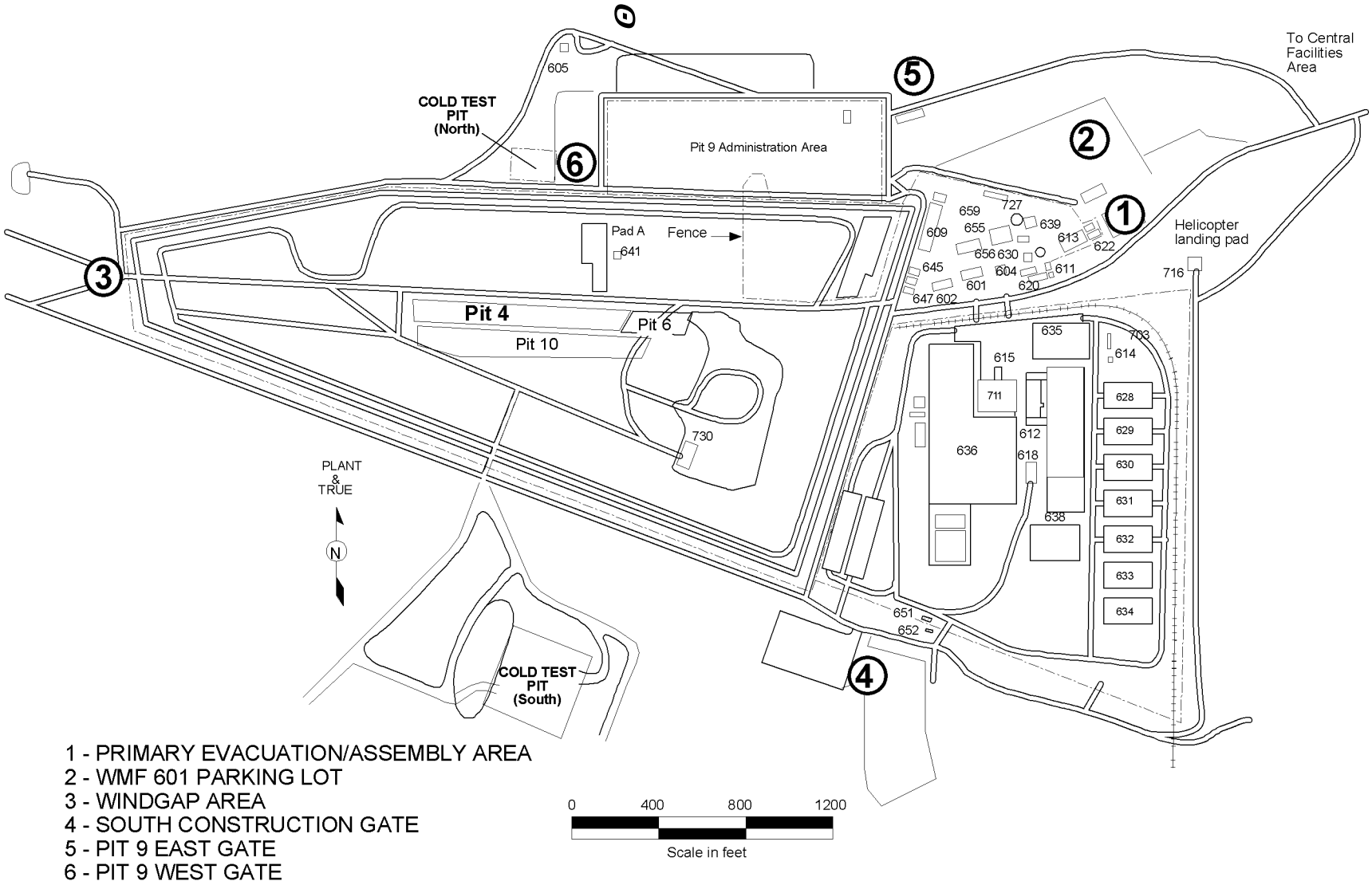

Figure 11-2. Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area take-cover locations and RWMC assembly areas.

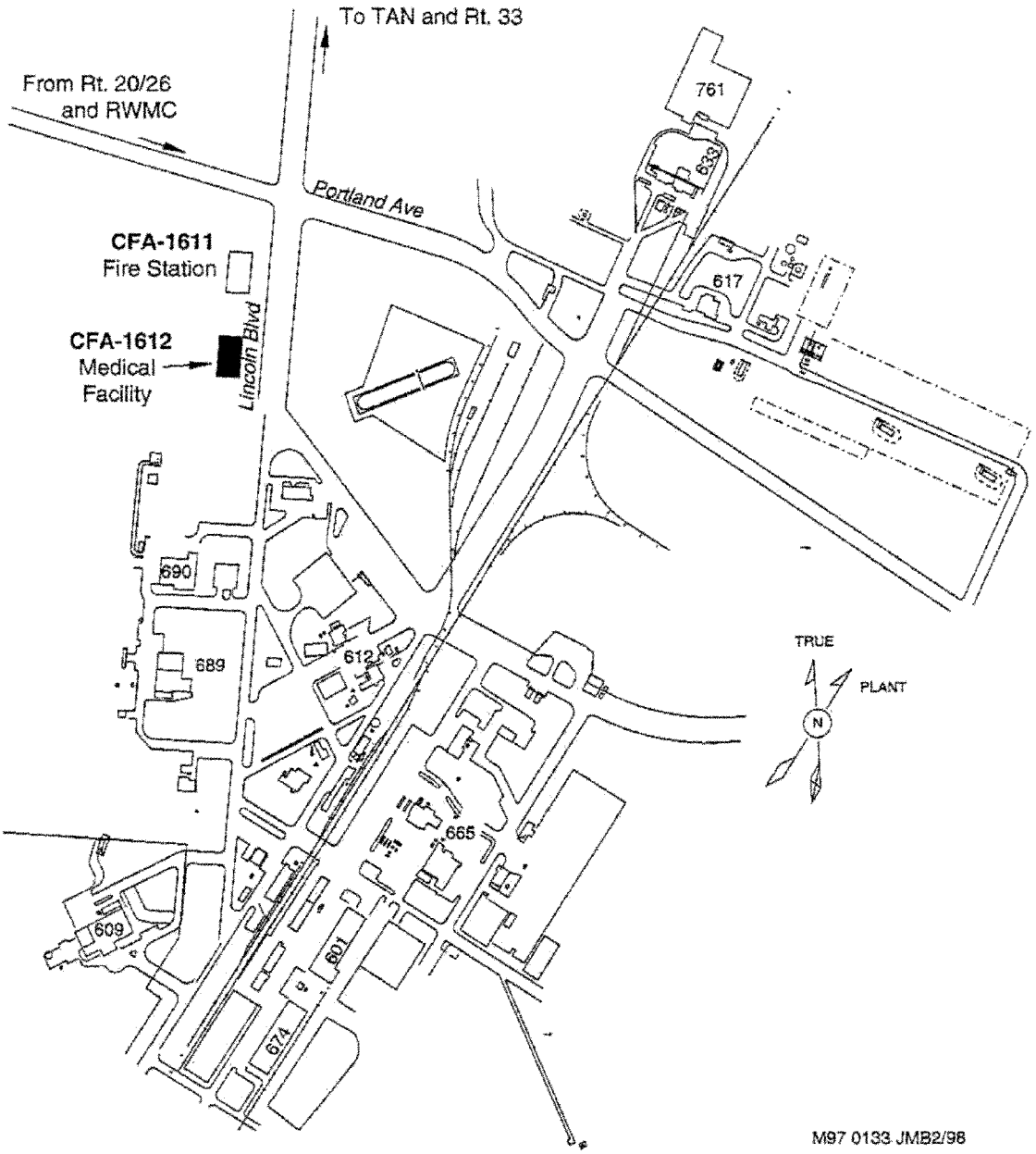

Figure 11-3. Route to the Central Facilities Area medical facility (WMF-1612) from the Radioactive Waste Management Complex.

- Assist in evacuating injured or incapacitated personnel from the affected area
- Evaluate and report damage to equipment and facilities
- Measure and record radiation and/or hazardous material levels
- Establish new work control zones and radiologically controlled areas.

11.7.2 Recovery

During an OU 7-13/14 project event, or RWMC or INEEL emergency, actions are directed toward protecting personnel and limiting consequences of the incident. Once initial corrective actions have been taken and effective control established, response efforts shift toward recovery. Recovery is the process to assess post-event or emergency conditions and develop a plan to return to pre-event/emergency conditions (when possible) and follow the plan to completion. The RWMC EC is responsible to determine when an emergency situation is sufficiently stable to terminate the emergency and enter the recovery phase.

As soon as practical after the emergency is terminated, the RWMC EC, or assigned recovery manager (appointed by the RWMC facility manager), will assemble all participating personnel (recovery team) to verify existing conditions, review the event in detail, and determine and assign corrective actions. If necessary, the RWMC EC or recovery manager initiates or requests an investigation before determining corrective actions. The recovery team will be composed of key project personnel (e.g. HSO, IH, SP, RadCon, FPE) and other technical representatives, as deemed appropriate by the recovery manager (e.g., chemical safety, explosives safety). Investigations include personnel interviews and incident assessments that can be presented during debriefings and critiques.

11.8 Critique of Response and Follow-up

Following all emergency drills, actual events, or an INEEL emergency, a review and critique of the incident will be conducted. This will involve reviewing and revising affected aspects of this emergency response plan according to new site conditions and lessons learned from the event or emergency response. When reviewing the emergency drill, event, or emergency information, typical questions considered include the following:

- What caused the event or emergency?
- Was it preventable? If so, how?
- Were procedures for prevention of the event or emergency adequate? If not, how can they be improved?
- Were all phases of the event or emergency response adequate? How could it have been improved?
- How did the event or emergency affect the site profile? Were other areas affected?
- Was the public protected?
- Was the environment affected (onsite/offsite)?

11.9 Telephone and Radio Contact Reference List

Emergency contact names and numbers are listed in Table 11-4. As a minimum, this list will be posted at the OU 7-13/14 project field trailer and in the CRZ or EZ (inside the drill-rig control trailer). Since personnel listed may change frequently, working copies of this list will be generated, as required, to note new positions and personnel assigned. This HASP should not be revised with a DAR to note these changes.

Table 11-4. OU 7-13/14 project emergency contact list.

Contact	Phone Number
Warning Communications Center (WCC)	INEEL phone -777
Fire/Security	Cell phone - 526-1515
Medical Emergency	Construction-net or WCC/emergency channel on hand-held radio "KID-240"
RWMC shift supervisor	526-2767
First-aid (CFA medical dispensary, Bldg #1612)	777, 526-2356
Occupational Medical Program (WCB dispensary)	526-1596
WAG 7 Manager—J. M. Schaffer	526-3029, pager 6451
OU7-13/14 Probing Project Manager—A. R. Baumer	526-3238, cell 521-7849
ER SH&Q Manager—Charles Chebul	526-9566, pager 5689
WAG 7 SH&QA point of contact—R. L. Roblee	526-4731, Pager 5757
Field team leader—B. P. Miller or J. L. Casper	BM - 520-4644, pager 568-2043 JC– 526-2682, pager 3434
Health & Safety Officer/Safety Professional—K. A. Wooley	526-2552, pager 7368
Industrial Hygiene—G. E. Downs	526-0127, pager 5829
Criticality Safety Engineer—J. T. Taylor	526-9656, pager 7571
RWMC Site Area Director—D. M. Bright	526-4223, pager 5270
RWMC ESH&QA Manager—T. L. Carlson	526-8062, pager 5724
Radiological control (RWMC Supervisor)—R. D. Sayer	526-6619, pager 5865
Radiological control (OU 7-13/14)—D. M. Everett	526-9780, pager 5898
RWMC fire protection—E. B. Gosswiller	526-8896, pager 6309
RWMC DOE representative—R. L. Knighten	526-5243, pager 7273

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